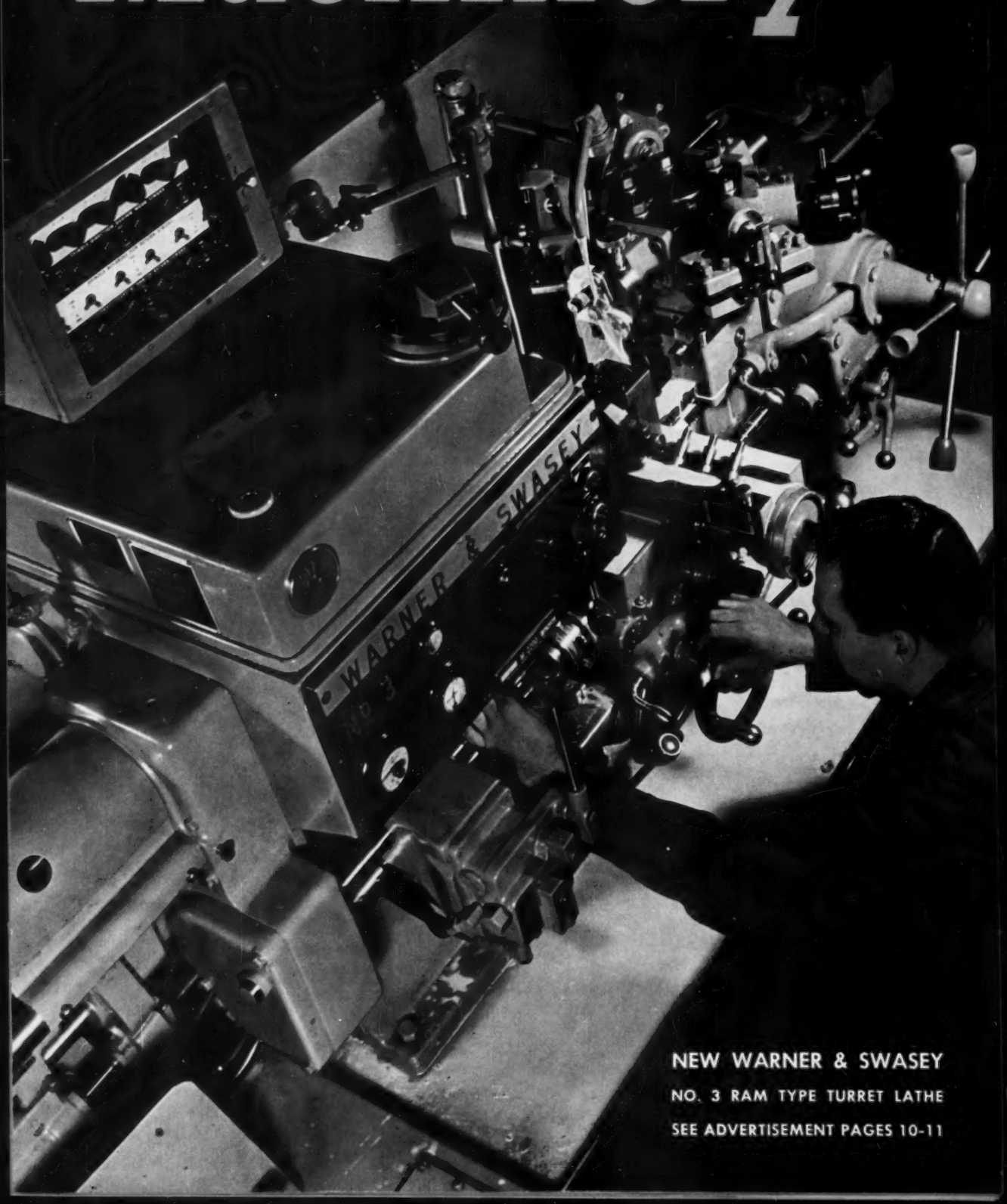
ENGINEERING AND PRODUCTION IN METALWORKING MARCH, 1961

Machinery



NEW WARNER & SWASEY
NO. 3 RAM TYPE TURRET LATHE
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TOOL-TIP GEOMETRY...

Elliptical or true Radius?

by Bruno A. Holmstrom
Chief Tool Engineer
The Heald Machine Company

To view this subject in its proper perspective, it is important to remember that no matter how large, complex or costly a boring or turning machine may be, it's the *tool tip* that does the work of removing metal. And on the proper geometry of this small but all-important part depends the success or failure of the entire machining operation.

One of the essentials of good tool design is the correct clearance angle between the work and tool at point of contact.

When finish cutting straight or tapered bores or O.D.'s, a varying clearance angle may be used, as all cutting is done with the outer tip of the tool where this angle is at the maximum. Here a conventional elliptical-point tool, where the clearance angle decreases on either side of the outer tip, is entirely satisfactory. Such tools can be accurately sharpened with an axis of tool reciprocation that is parallel to the face of the grinding wheel, as shown in Fig. 1.

However, when contour boring or turning spherical or irregular shapes, an entirely different situation occurs. Here, the point of contact on the tool tip varies from point to point on the workpiece, as shown in Fig. 2. If a conventional elliptical-point tool were used, the radius and clearance angle would vary from point to point on the work contour and optimum tool geometry would occur only at one of these locations.

For contour work, it is therefore preferable to use a true-radius tool tip—in which the clearance angle and radius is the same for any point on the cutting edge. To generate such a tip, the axis of tool reciprocation must be tilted with respect to the face of the grinding wheel, and this angle then becomes the constant clearance angle of the tool. This is shown in Fig. 3.

To permit grinding either *true-radius* or *elliptical-point* tools with maximum precision and economy, we developed the Heald Model 4 Tool Sharpening Machine. It is the *only* machine of its type which offers this choice of tool-tip geometry while providing fully automatic tool reciprocation for uniform and repetitive tool tip accuracy.

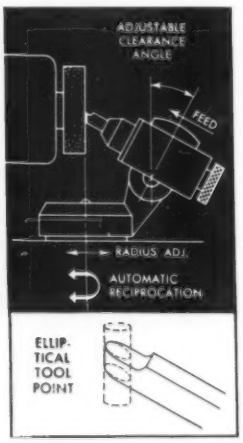

FIG. 1. Elliptical tool point with decreasing clearance angle for conventional straight-line work. Upper sketch shows arrangement of tool sharpening machine.

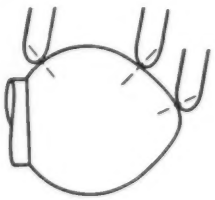

FIG. 2. Sketch showing how contact point of tool varies for different points on a contoured workpiece.

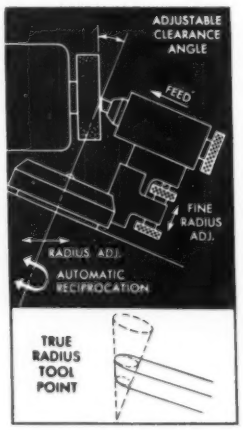

FIG. 3. True-radius tool point with constant clearance angle for contour boring or turning. Upper sketch shows tool sharpening arrangement.

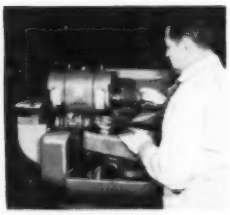

FIG. 4. Heald Model 4 Tool Sharpening Machine arranged for precision grinding of true-radius tool point.

Ask your Heald representative for complete information on the Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3. **It PAYS to come to Heald.**

THE HEALD MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
WORCESTER 6, MASSACHUSETTS

MARCH 1961

VOL. 67 No. 7

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Machinery

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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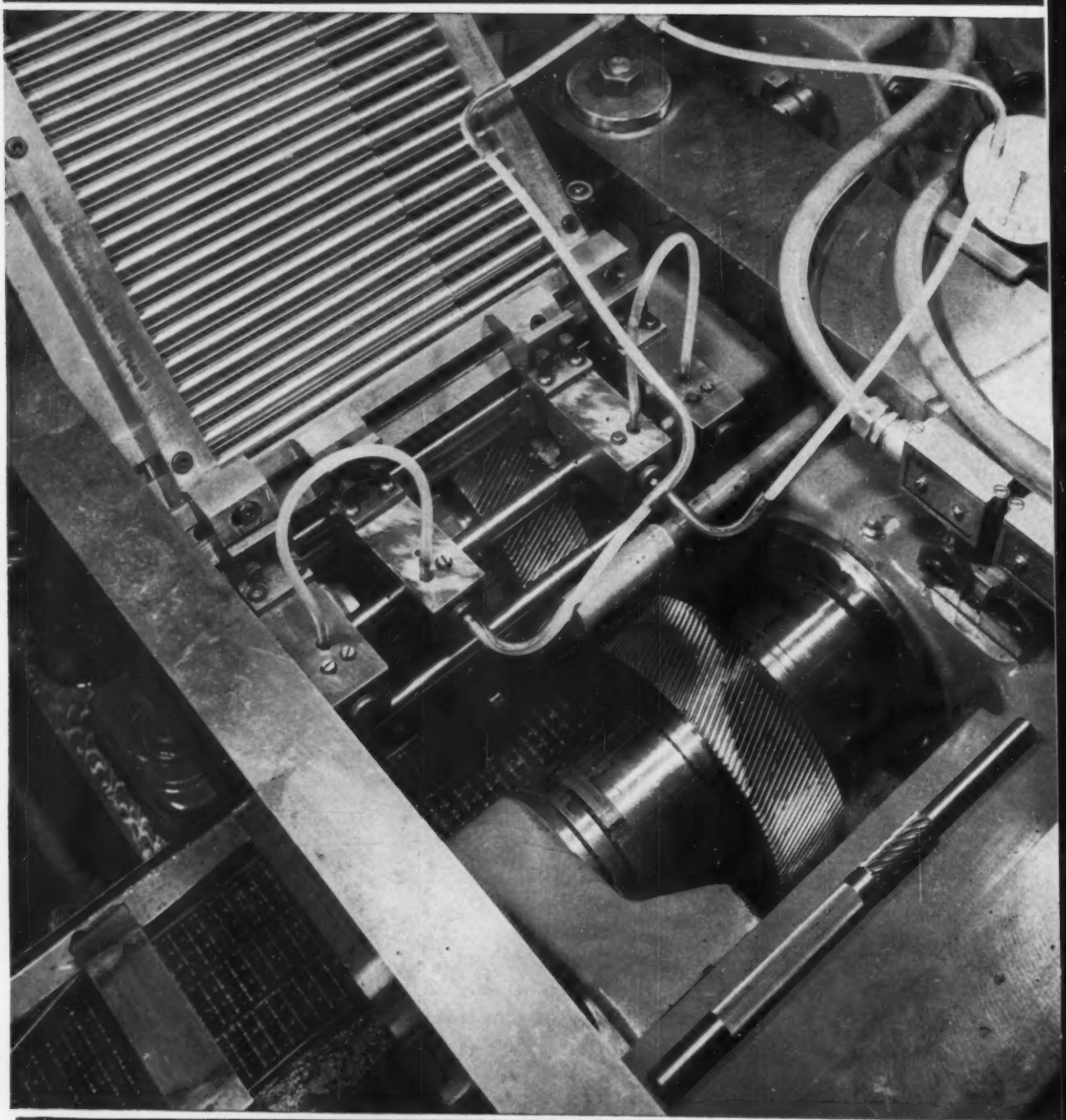
LANDIS *thread rolling machines*



prove versatility at CHRYSLER CORP.

Two highly versatile LANHYROL Thread Rolling Machines have proven their worth thread rolling both the spline and knurl on starter motor armature shafts at the Chrysler Corp. Electrical Equipment Plant, Indianapolis, Indiana.

In this operation, the two LANHYROL Machines are completely automatic with the workpieces being rolled by the infeed method with electro-pneumatic die cycling (see accompanying specifications and illustration).

Due to the versatility of the LANHYROL Machine cost-saving benefits result. For instance, if you were to select the thread rolling process and perform the thread rolling on the high-production LANHYROL, you undoubtedly would realize savings in the following ways:

1. One LANHYROL often can supplant two or more thread milling, hobbing or grinding machines to result in reduced handling and machine maintenance costs. A reduction in the overall per piece cost in terms of floor space needed to produce the product is also realized.

2. There is a material savings. Thread rolling offers substantial material savings since it generally requires less material than is required to produce a thread, gear or spline form by any other method.

3. Heat-treating is eliminated. The LANHYROL Machine produces strong, accurate threads of excellent finish in a chipless cold-forming process. Thus, thread rolling can often result in a sufficient work hardening of the workpiece and eliminates the need for subsequent heat-treating.

Adapted for manual, semi-automatic or automatic operations, the LANHYROL Machine can be used to thread a variety of forms (whether by the infeed, thrufeed, continuous or reciprocal methods) simply by using proper dies and tooling. Its power, versatility and 0 to 3" diametrical range capacity make it the most useful and productive thread rolling machine available. For further information send your specifications and ask for Bulletin E-60.

SPECIFICATIONS

Workpiece Specifications:

Material	C1144 steel
Workpiece length	11"
Involute Spline	.625 P.D., 21.1849/ 40 pitch, 12 tooth, 30° pressure angle, 25° right-hand helix angle, 1-13/16" long
Knurl	.633"-.638" diameter, .040" pitch, 49 tooth, 90° straight knurl, 3-3/4" long

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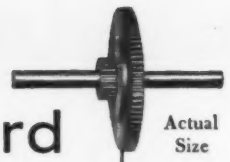
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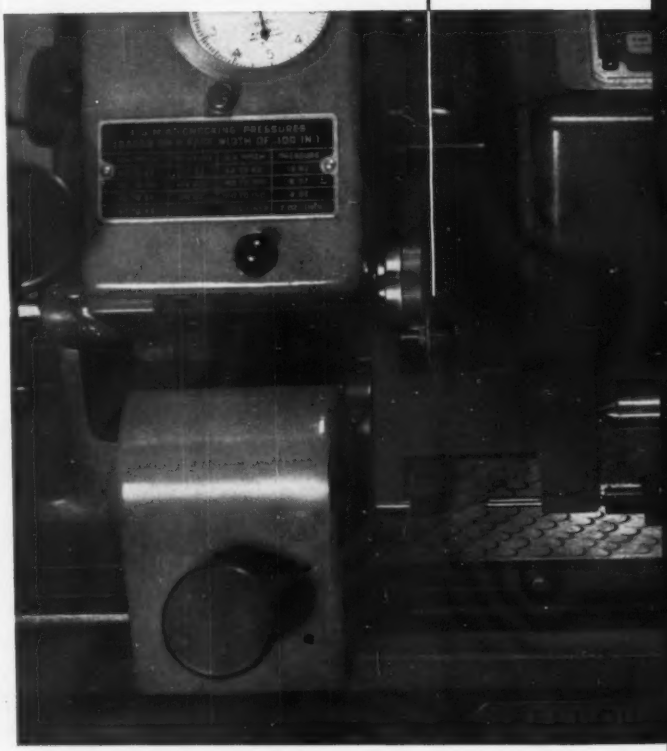
Now, the No. 4 Red Liner makes "composite" checks on the finest instrument gears with unbelievable accuracy and sensitivity. 1600 to 1 magnifications are obtained with the electrical recording system which gives a written, unbiased record for instant reading or for proof-of-accuracy files.

One report states – "11 teeth, 200 D. P. pinion backed up to a 100 tooth gear on a cluster, checked easily on the No. 4 Red Liner."

The job shown is 96 pitch with 22 teeth on the small gear and 80 teeth on the larger gear. The pinion shaft rides in vees in a turret-type fixture.

Fellows inspection units cover a range from the tiniest instrument gear up to some that are 24 inches in diameter.



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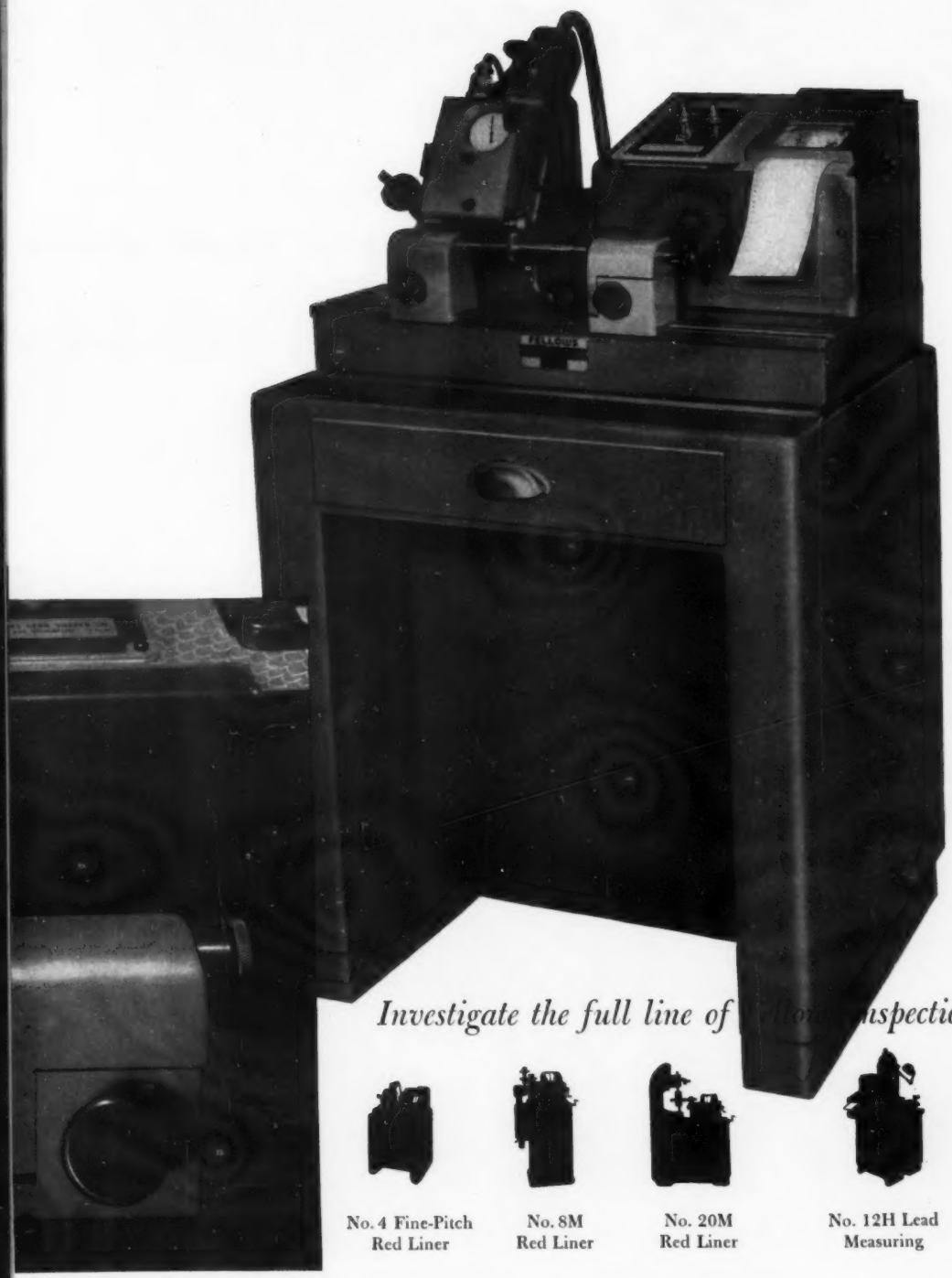

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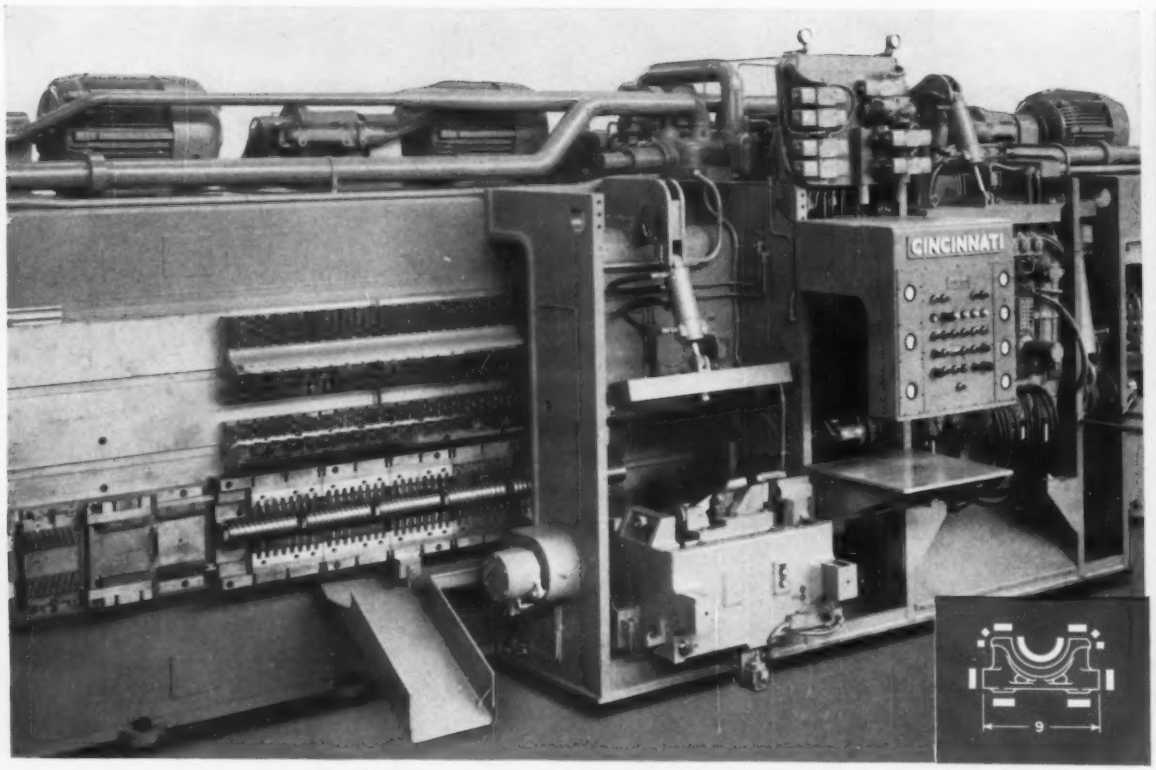

Thirteen sizes of main bearing caps are surface broached on this CINCINNATI Horizontal Hydro-Broach Machine. Throw-away tool bits help in keeping costs at a minimum while producing 80 parts per 48 minute hour. Catalog M-1910 contains specifications.

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

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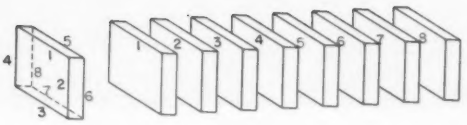

Throw-away tool bits for broaching (patent pending) have eight cutting edges. After one edge is used, the bits are unclamped, turned 90° to make the second edge available, and so on. Both sides of the bit are used (negative rake angle).

Throw-away Tool Bits

Twin rams with duplicate tooling on this CINCINNATI Duplex Vertical Hydro-Broach are responsible for a production rate of 325 parts per 48 min. hour. Operation—broach flat surface of compressor cylinder heads. Throw-away tool bits are one of the many plus factors in reducing costs to a new low. Catalogs M-1745-1 and M-1848-1.

How will broaching stack up against milling or other machining methods? Cincinnati Milling's Engineering Service Specialists can give you the answer. How will *throw-away tool bits for broaching* stack up against those requiring resharpening? Cincinnati Milling's Engineering Service Specialists can answer that too. These men consider every facet of machining cost. Throw-away tool bits for broaching, a new idea offering substantial cost reduction, was one of the considerations in tooling up the two Hydro-Broach Machines illustrated at the left. The throw-away idea won out by a wide margin, and with highly gratifying results.

Horizontal Hydro-Broach Machine, far left, broaches several surfaces on 13 sizes of main bearing caps. Fixtures are the progressive type, for the following sequence of four operations: 1) thrust face, 2) opposite thrust face, 3) bolt head seats, 4) half bore, joint face, bearing lock and chamfer. Cutting tools for the half bore and finishing operations are the conventional brazed carbide type, while others are throw-aways. In actual production during the past several months, tool bits are indexed every 24,000 to 29,000 parts, and eight cutting edges are used.

Duplex Vertical Hydro-Broach Machine, left, is broaching the bearing surface of compressor cylinder heads, producing two parts each machine cycle. At 80% operator efficiency, 325 parts per hour are surface broached. Here, too, throw-away tool bits give this fine machine an extra measure of low-cost performance. Standard cost-reducing feature-advantages include tilting tables, for fast, safe work handling . . . automatic clamping operated by cycle start buttons . . . automatic pressure lubrication . . . hardened and ground ways.

These two machines are typical examples of the advanced thinking and modern approach to low-cost production which Cincinnati imparts to broaching machines, production lines and every type of equipment built to your requirements by the Special Machine Division. Many specialists in this Division are available to study your machining problems and recommend equipment to reduce costs and improve quality. May we hear from you?

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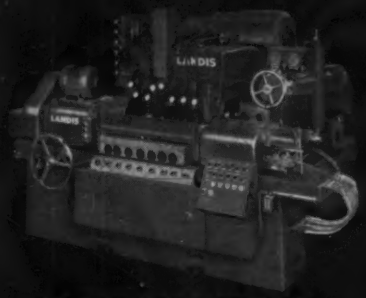

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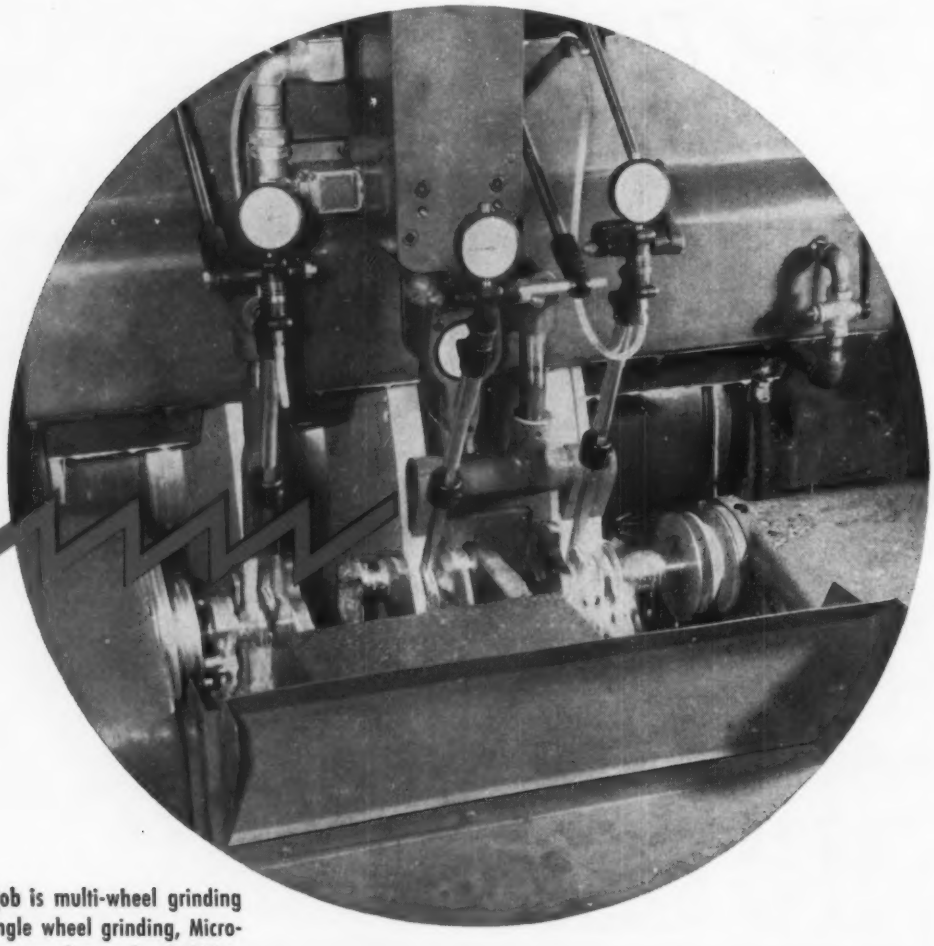

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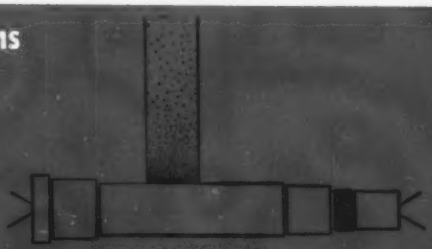

multiple diameter shaft
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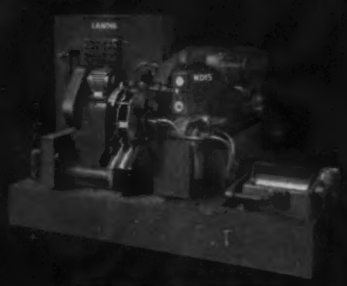

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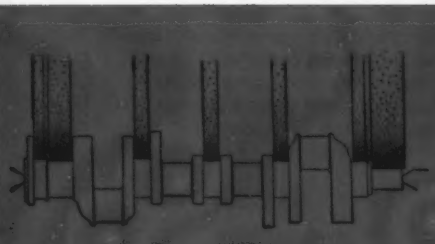
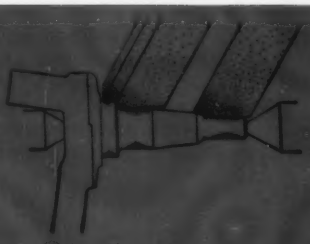


crankshaft line bearings
specified size tolerances: .0005"



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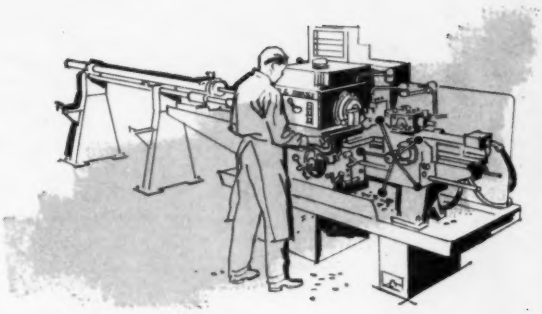

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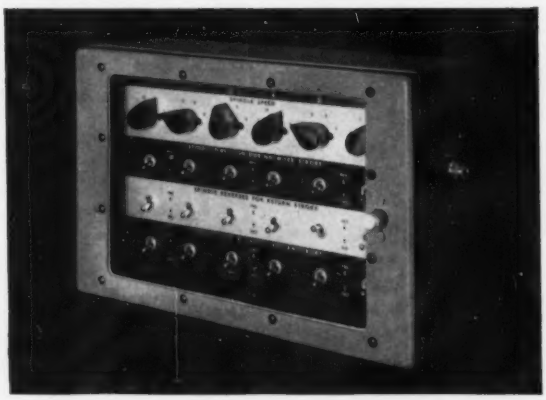

The Electro-Cycle attachment (optional) eliminates all headstock handling. Spindle start, stop, reverse, and speed selection are all preset on this setup panel and actuated electrically by index of the hexagon turret. This permits the operator to disregard all spindle control functions, leaving him free to develop his best operating rhythm for efficient, fast-cycle work.

The new eight speed (16 with a two-speed motor) all-hydraulic automatic headstock gives you more speeds in a wider range—from 45 to 2262 rpm—for maximum cutting efficiency in all materials.

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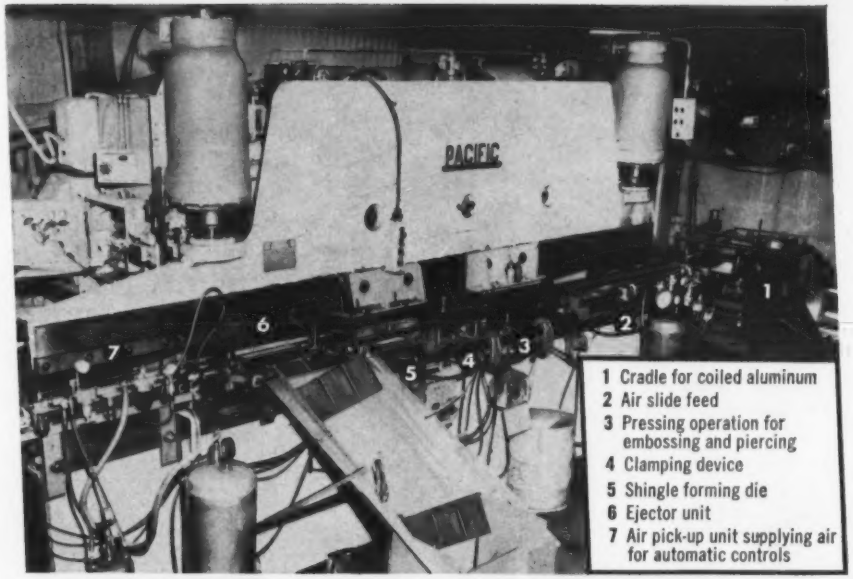

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6 Ejector unit
7 Air pick-up unit supplying air for automatic controls

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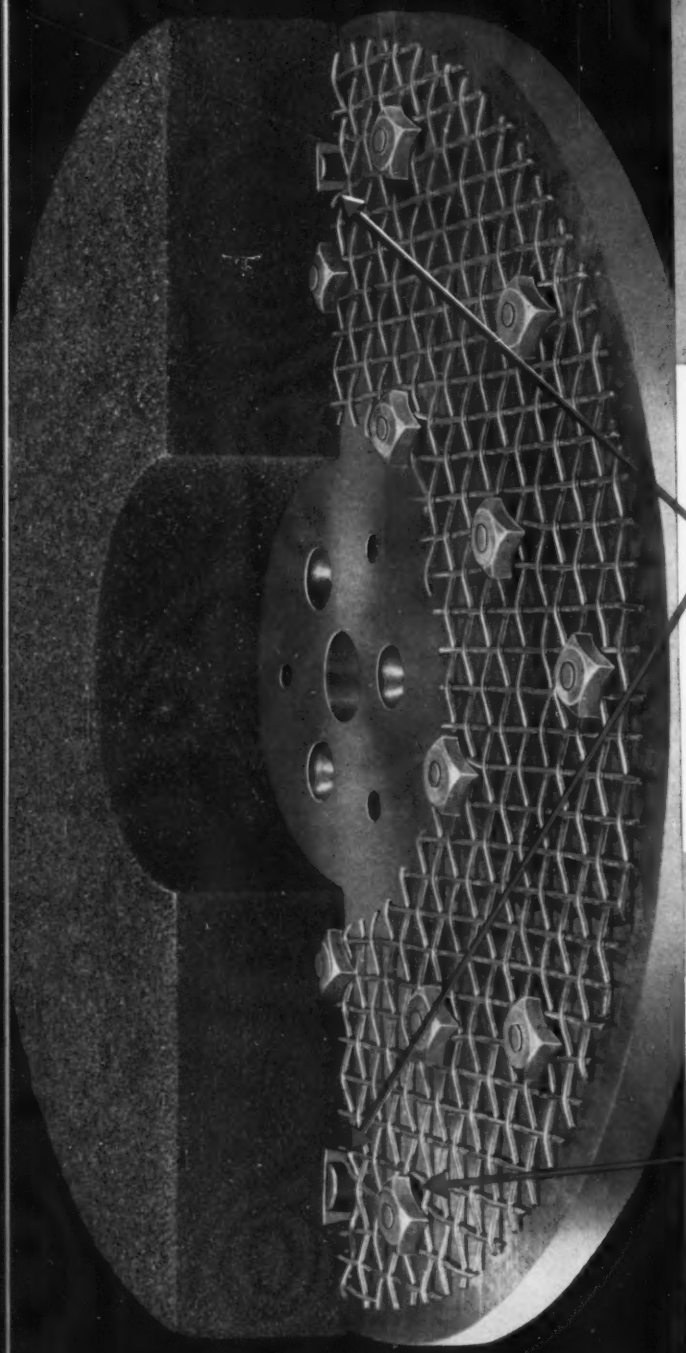
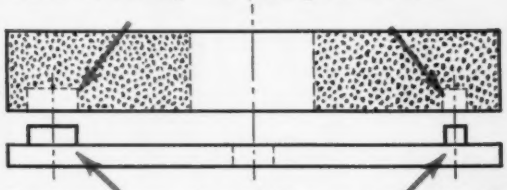


Gardner disc features add safety... improve accuracy

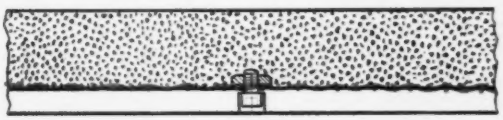
Gardner TRU-LOK® disc mounting
truer running—closer precision



Proper centering of disc on steel wheel assured by Tru-Lok.

Greater accuracy—Tru-Lok eliminates run-out and vibration caused by off center mounting.

Gardner WIRE-LOKT® construction
maximum safety—maximum economy



Full value—the entire rated thickness of the abrasive is usable.

Safety—heavy, imbedded steel mesh assures maximum safety.

Call the man who can give you the *most* in practical, cost saving help with your flat surface grinding . . . your Gardner Abrasives Specialist.

GARDNER

abrasive discs

BELOIT, WISCONSIN

Sectionized Transfer-matic Introduces New Concepts of Processing 4-Cylinder Blocks

A significant forward step in automation has been achieved by a new Cross Transfer-matic which integrates all operations except broaching that are required to finish cylinder blocks of three different horsepower capacities. The multiplicity of operations in a single machine and the fact that the entire line was created by one builder result in large reductions in engineering, materials handling, control circuitry and floor space.

The new Transfer-matic consists of six sections with a total of 121 stations. Three banking conveyors are provided between appropriate sections.

In Sections I and II, most of the heavy metal removing operations are handled. These include straddle milling the main bearings, milling the oil slinger grooves, rough drilling the valve lifter holes, rough boring the cylinders, rough boring the camshaft and milling the ends of the block.

In Section III, the sides are completely machined and the accessory and engine mounting pads are milled.

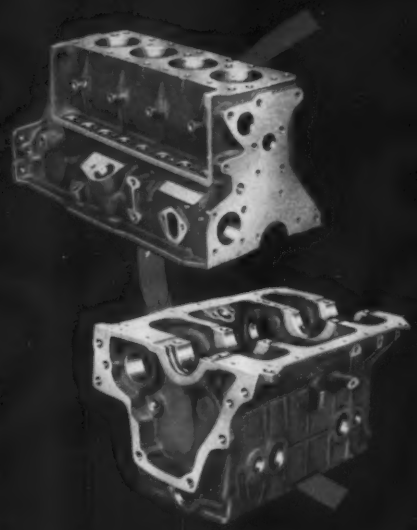
In Section IV, the operations on the top and bottom of the part are performed and the valve lifter holes are finish machined. A special coolant system is employed.

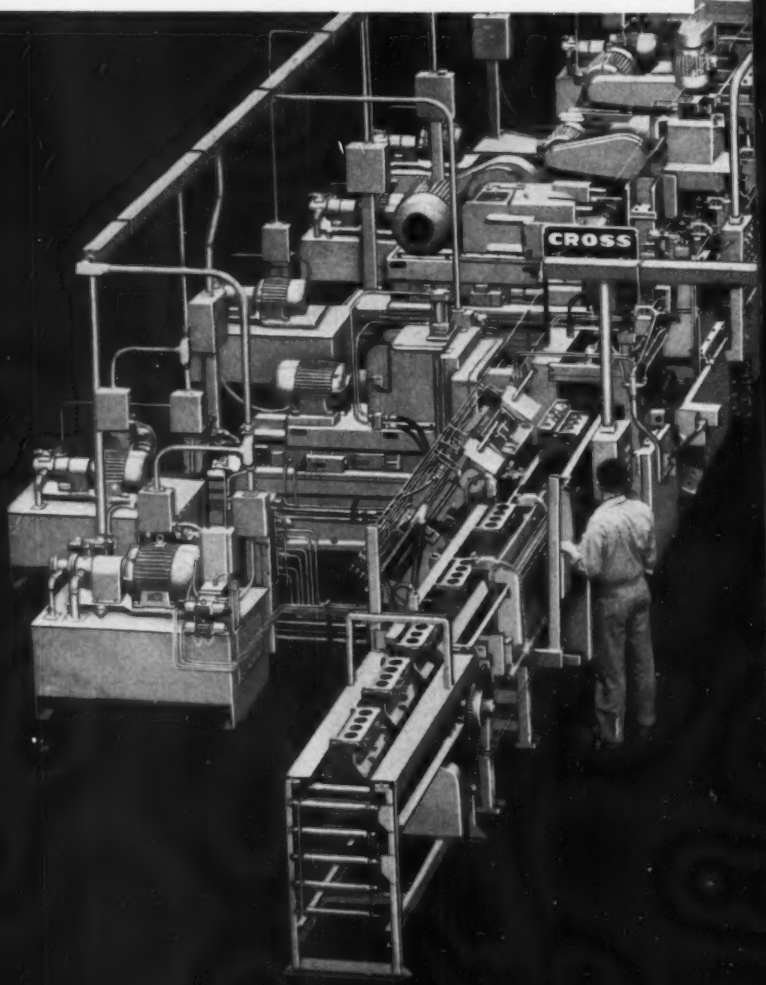
In Section V, the block is washed and the bearing caps are assembled.

In Section VI, the cam and crank boring operations and inspections are completed.

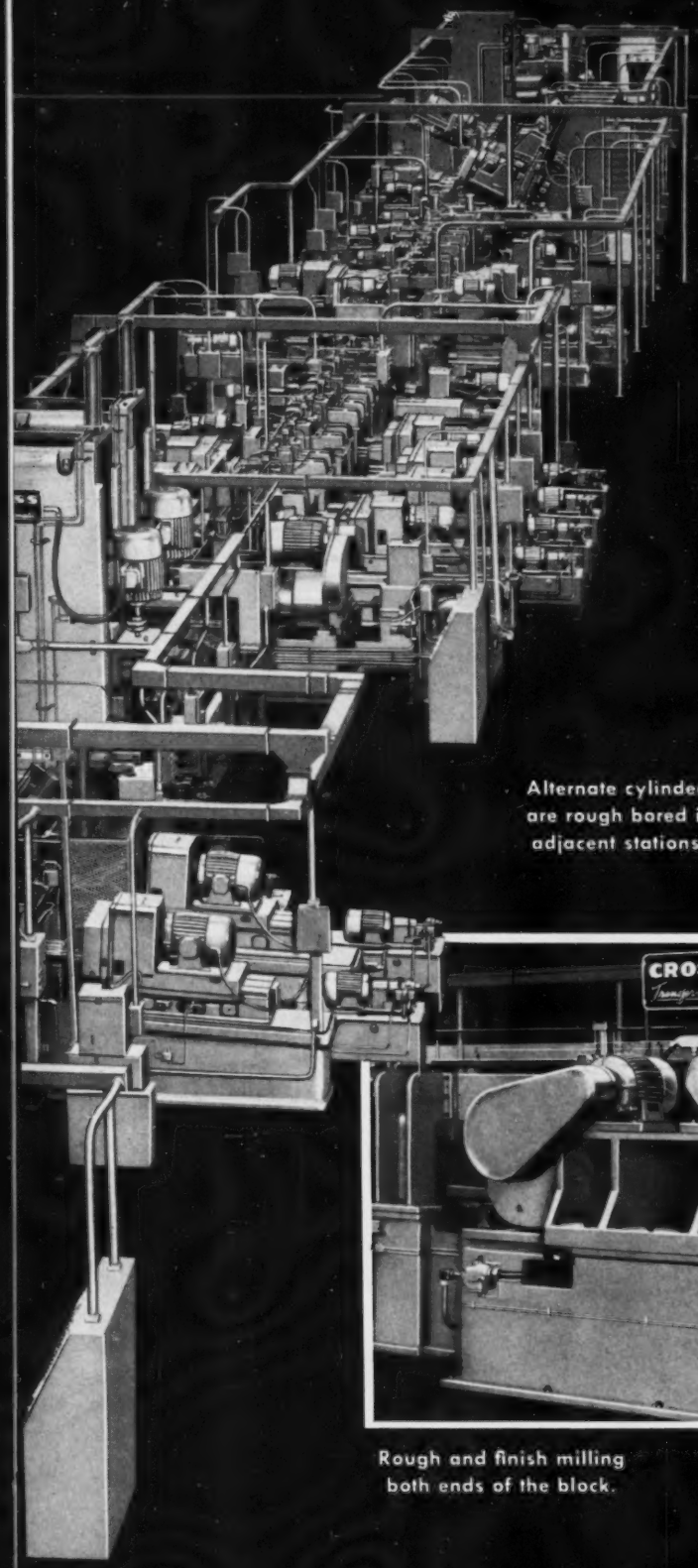
At 100% efficiency, production is at the rate of 109 blocks per hour.

A Cross sales engineer would like to acquaint you with features of this Transfer-matic in detail.

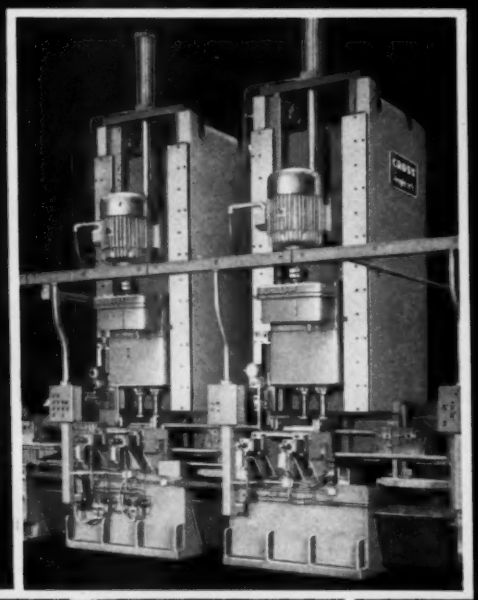


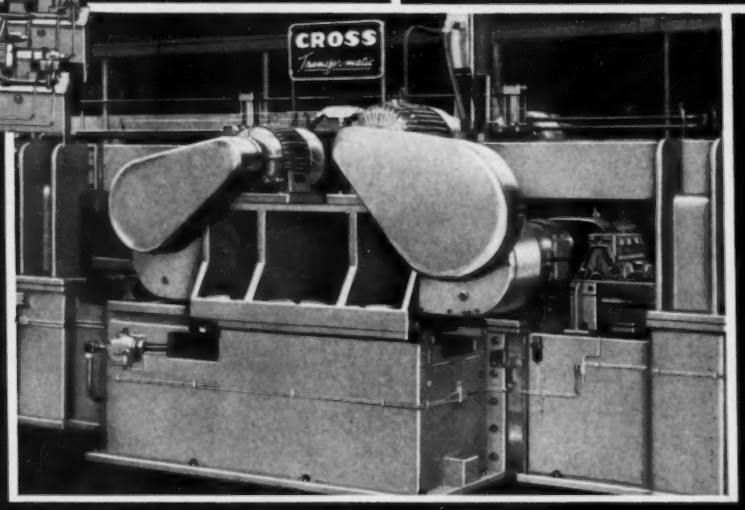


Another Transfer-matic by Cross



Alternate cylinders are rough bored in adjacent stations.





Rough and finish milling both ends of the block.

Established 1898

THE CROSS CO.

First in Automation

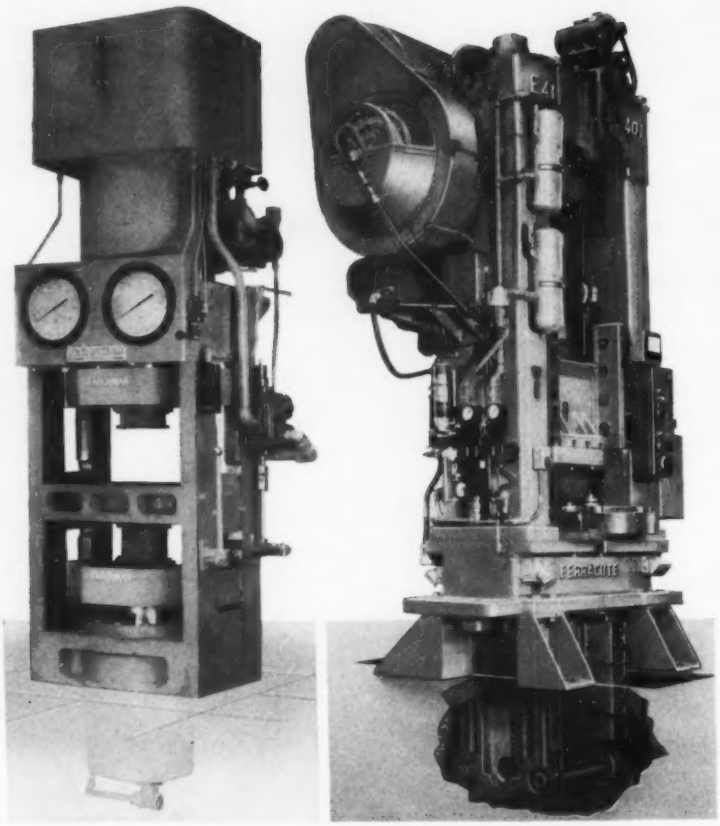
PARK GROVE STATION • DETROIT 5, MICHIGAN

How to produce
POWDERED METAL PARTS
efficiently and economically...

from start . . . to finish

Farquhar HYDRAULIC | **FERRACUTE** MECHANICAL

For initial compacting of powdered metals, choose a hydraulic from complete range of tonnages and sizes. 225-ton double ram type compacting press illustrated.



For restriking and sizing, select exact mechanical size from Ferracute's complete line. Shown — 400-ton double toggle compacting press with 100-ton lower knockout.

Consult us on efficient methods of press production of powdered metal components.

Since 1863

FERRACUTE MACHINE COMPANY

Builders of Power Presses and Special Machinery
Dept. B, Bridgeton, New Jersey, U. S. A.

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Cost-Cutting-

A SIMPLE MATTER OF SELECTION

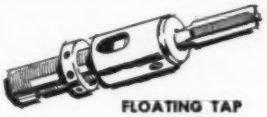
59-15

COUNTERBORE SETS

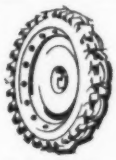
INVERTED SPOT FACERS

COUNTERBORES—

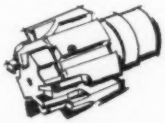
COUNTER SINKS, HOLDERS, PILOTS



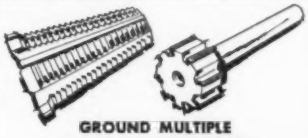
FLOATING TAP DRIVERS



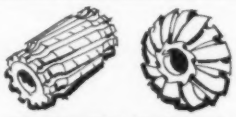
INSERTED BLADE FACE MILLS



MULTIPLE DIAMETER BORING CUTTERS



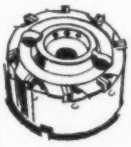
GROUND MULTIPLE THREAD MILLING CUTTERS



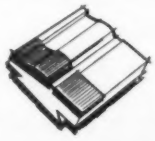
GROUND AND UNGROUND FORM-RELIEVED CUTTERS

SINGLE-POINT CARBIDE TIPPED TOOLS

MULTIPLE STEP BORE REAMERS



CARBIDE TIPPED CYLINDER BORING CUTTERS



DOVETAIL FORM TOOLS

CARBIDE TIPPED BROACH SECTIONS

INVOLUTE SPLINE SHELL TYPE BROACHES

Every standard and special tool is of but one quality—the finest available. Since 1921, Continental has specialized in cost-saving cutting tools (just a few of which are shown at left), producing design innovations in hardened, high-speed tool steel, carbide and special-alloy cutting materials.

Available in the types and sizes required to do the *complete* job from rough to finish, Continental Cutting Tools are job-tested in the toughest proving ground—Ex-Cell-O's own machine tool and precision parts production lines. As a result, they come to you ready to increase the output of even your best machines!

Continental engineers will be glad to work with you in selecting the correct CTW Cutting Tool for long life and maximum performance. See your local Ex-Cell-O Representative, or write direct to Continental Tool Works Division for full details. In Canada, contact your local Ex-Cell-O Sales Associates Representative or write direct to Colonial Tool Co., Ltd., Windsor.

Continental **TOOL WORKS**

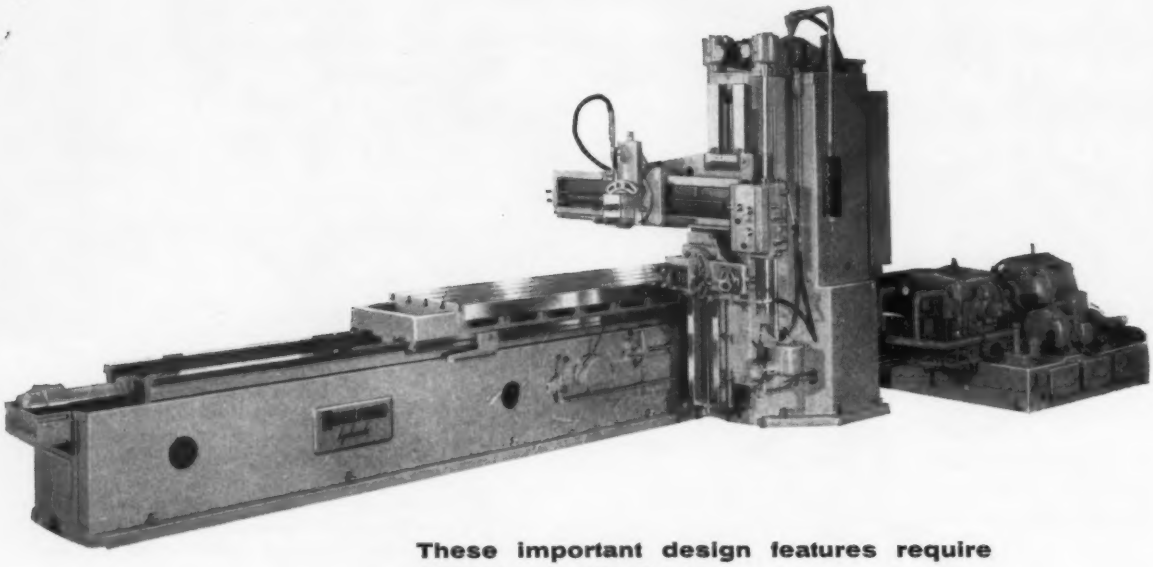
DIVISION OF

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

A little maintenance goes a long way!

. . . on RMT SHAPER-PLANERS



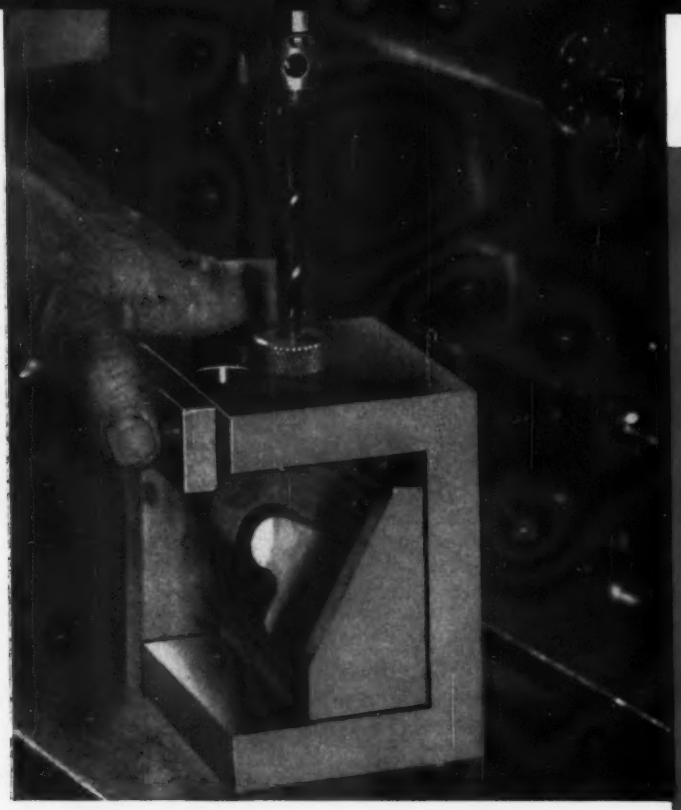
These important design features require almost no attention:

- Table stays on bedways — Dash-pot cylinders prevent overtravel and running off the bed.
- Few moving parts and automatic lubrication are inherent features of hydraulic drive.
- Positive mechanical reversals — table-dogs actuate pilot valve for table reversals, feed, and tool lifters — no electrical contactors to wear or fail.

Maintenance is an important factor to consider in any contemplated capital investment. You will certainly want to compare these features with new or present equipment!

For complete information, write RMT Co. — or contact your nearest RMT representative.

ROCKFORD MACHINE TOOL CO. ROCKFORD, ILLINOIS



Now—A Low-Cost Way to Build Jigs & Fixtures!

PRE-MACHINED MICRON SECTIONS PUT YOUR TOOLROOM JOBS ON A PRODUCTION BASIS

Next time you need fixtures for short-run milling or drilling jobs, use Ex-Cell-O Micron Sections to produce them quickly and at low, low cost!

High tensile strength cast-iron Micron Sections give you inbuilt accuracy plus substantial savings in design and building time; you eliminate welding, cut machining time.

Simply select the desired shape and size from Ex-Cell-O Bulletin B-5914, and specify the length required; we'll deliver the sections you need—pre-machined and ready for minor detailing.

Micron Sections are available from stock by ordering through your local Representative or direct from Ex-Cell-O. Send for data sheet and price list today.

BRIEF SPECIFICATIONS

Cut to order from 25″ lengths. Wall thicknesses from ⅜″ to 1¼″. Width and height from 3″ x 3″ to 8″ x 8″. Machined square and parallel within .005″ per foot on all surfaces except ends and interiors of hollow shapes.

EX-CELL-O FOR PRECISION

Machinery Division

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NEW TOOL STEEL SERVICE

simplifies purchasing (and saves money, too)

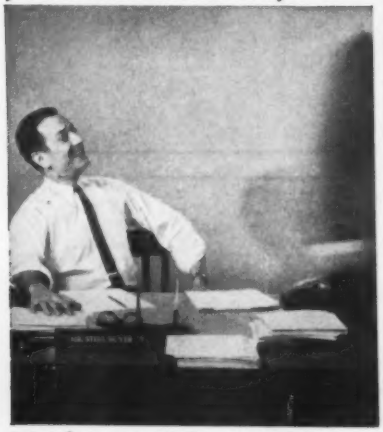
Buying assorted brands of tool steel creates costly paperwork for your . . .

purchasing and receiving departments — manufacturing and accounting, too.

With Crucible's new Tool Steel Service you cut these costs substantially

because you buy fewer grades of tool steels to do more jobs . . .

eliminate piles of paperwork throughout your plant . . .



carry fewer pounds in stock (reduce chances of inventory "mix-ups"), and . . .

pay a lower price per pound (by eliminating costs for small quantity "extras").

For the full story, call in a CRUCIBLE Service Engineer.

CRUCIBLE STEEL COMPANY OF AMERICA

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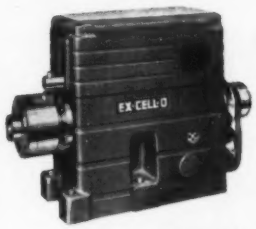
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

IMMEDIATE DELIVERY

STYLE 28-A
HYDRAULIC POWER UNIT

STYLE 22
HYDRAULIC POWER UNIT



STYLE 20
HYDRAULIC POWER UNIT

STYLE 502
LEAD SCREW TAPPING UNIT

Ex-Cell-O Hydraulic Power Units in Stock Now to Cut Your Machine Tool Lead Time and Production Costs!

Reduce lead time, increase productivity, and cut per-unit cost with Ex-Cell-O Quill-Type Hydraulic Power Units—immediately available for drilling, counterboring, spot-facing, and reaming operations, or as prime movers for milling equipment.

Ex-Cell-O Hydraulic Power Units are self-lubricated . . . built for easy installation, and trouble-free operation, even under fast cycles and continuous production. Compactness allows close center distance installation, in-line or radial . . . versatility makes them ideally suited for special-purpose, high production machines. A companion product, the Style 502 Tapping Unit, uses a lead screw for trouble-free tapping.

See your Ex-Cell-O representative or write direct for full information on the complete line of Hydraulic Power Units and our Canadian-built Lead Screw Tapping Unit.

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

60-42

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So it doesn't break---*So what??*

So we can bend a MARVEL High-Speed-Edge Hack Saw Blade double, and it won't break. Does this prove anything?

Let's see if it does. When you buy a box of hack saw blades, you expect each blade to have a reasonable cutting life. For example, take an ordinary blade that costs $4.00, and you expect it to produce 2000 sq. inches of accurate cutting-off before it is discarded. Would you be willing to pay $8.00 for that same blade? *You will, if it breaks halfway through its expected life.*

Bending a MARVEL High-Speed-Edge Hack Saw Blade to demonstrate that it is truly unbreakable proves the point that you get every square inch of blade life you pay for when you buy MARVEL Blades.

Safety to both operator and machine, plus maximum blade life, seem like value enough from this remarkable blade. However, these MARVEL Blades give you even more, for they will cut faster, with greater accuracy because they can be safely tensioned more taut in your machine than ordinary "breakable" blades and are therefore more rigid to resist deflection.

Cost? Unbreakable MARVEL High-Speed-Edge Hack Saw Blades are priced competitively. Use MARVEL Blades consistently with complete confidence because they have no equal for value. Leading Industrial Distributors stock and sell MARVEL. Ask yours today.

ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

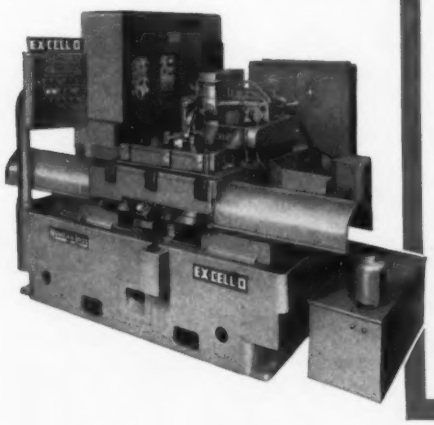
MARVEL Metal Cutting SAWS
Better Machines–Better Blades

Looking for **precision parts** for your product? Look to the builder of the world's most accurate production machine tool!

Ex-Cell-O, builder of the "world's most accurate production machine tool," is staffed and equipped to put into parts for your products the same degree of machining skill, modern heat treat methods, and advanced assembly and inspection techniques that go into our own precision products.

Whatever your requirements in the size, material or quantity of prototype or production parts and assemblies, your job will receive the extra attention to detail and scheduling which many of our customers have relied on for more than 40 years.

Contact your local Ex-Cell-O Representative for details, or send your prints or specifications to Ex-Cell-O. Your inquiry or request for quotations will receive prompt attention.



Precision parts and assemblies, ground worms

Miscellaneous production parts, drill jig bushings

Machined forgings, hardened and ground railroad details

Tape-controlled Numera-Trol Precision Contouring Machine is controllable to .000025", has templet scribing-grinding head and interchangeable turning-boring head.

60-49

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

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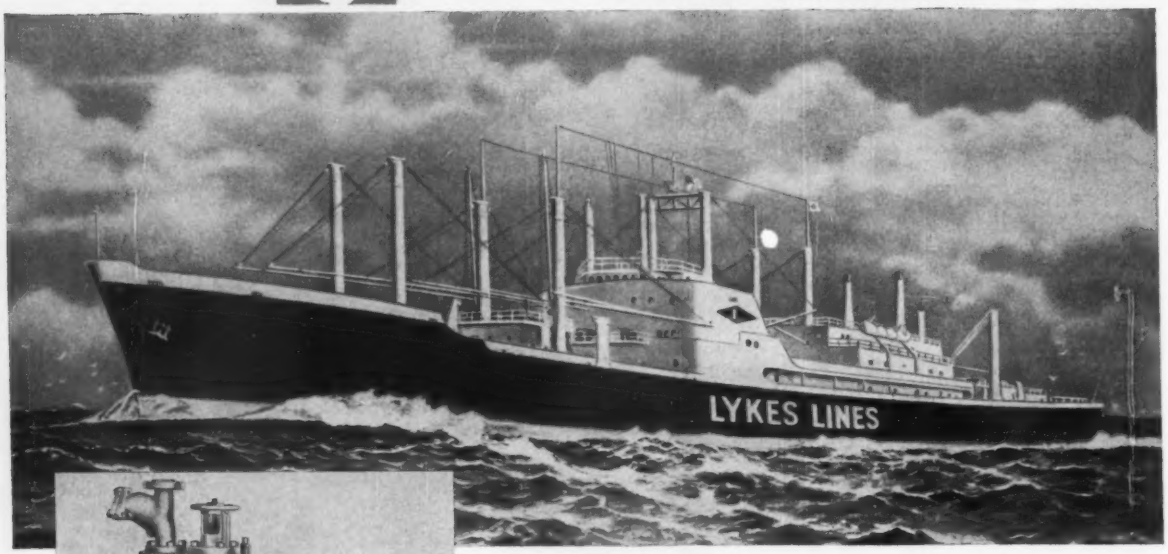
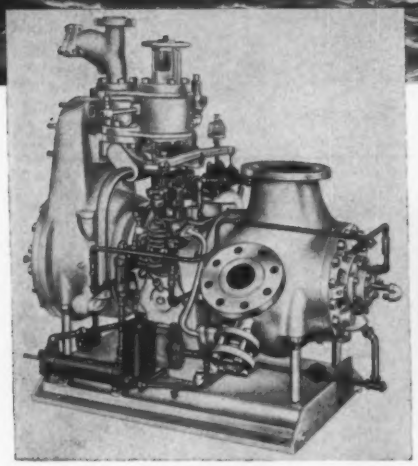
MARLIN-ROCKWELL RELIABILITY COUNTS *in* COFFIN *boiler feed* TURBO PUMPS





The fast, new Lykes Cargo Liners ply the Atlantic in coastwise shipping.

Boiler Feed Services for these 494 foot vessels are provided by Coffin Turbo Pumps equipped with MRC Precision Ball and Roller Bearings.

MRC Ball and Roller Bearings are used in a variety of marine applications. MRC engineers, with 63 years background of bearing knowledge, are prepared to discuss your bearing problems with you.

MRC pioneered, developed and produces the Super-Precision Ball and Roller Bearings, shown here, for high temperature, high speed and to provide the ultimate in accuracy and load carrying capacity.

MARLIN-ROCKWELL CORPORATION

Executive Offices: **Jamestown, N. Y.**

MRC BALL AND ROLLER *bearings*

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CAM BORE PRECISION... AT THREE TIMES THE SPEED OF A BAR AUTOMATIC

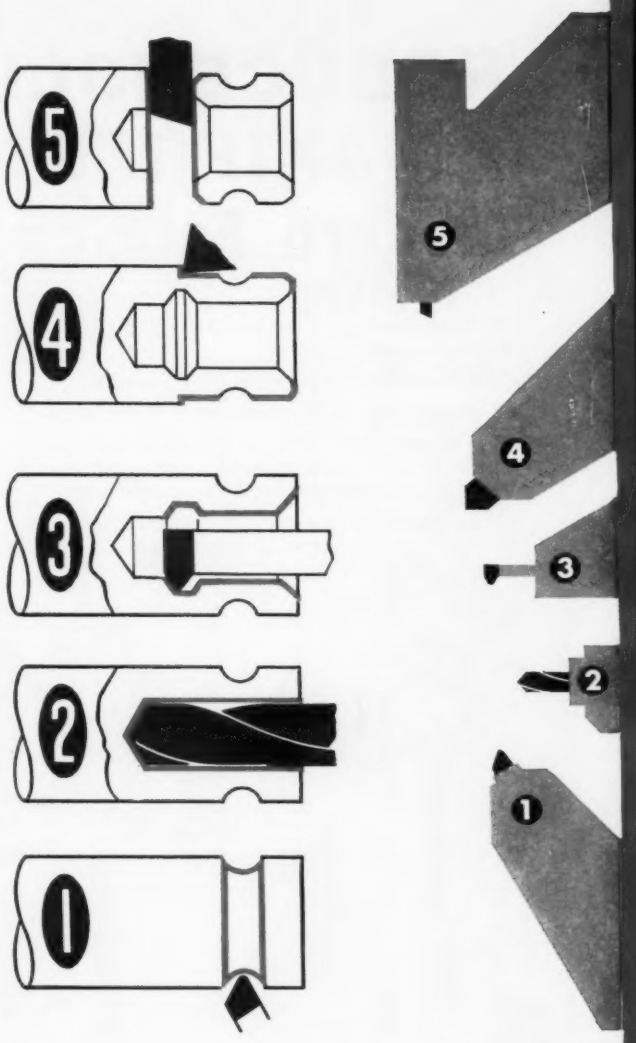
STANDARD STYLE 308 BORES AND CONTOURS MINIATURE BEARING RACES FROM BAR STOCK

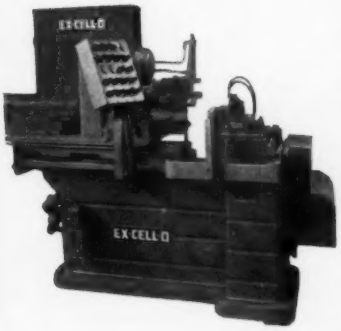
Take a standard Ex-Cell-O Style 308 Cam Boring Machine, feed bar stock through its Ex-Cell-O Precision Spindles, and add the tooling shown at right.

The result: 380 miniature bearing races per hour, gross—produced three times faster, 10 times more accurately, and with more operations and a finer finish than possible with the bar automatic assigned to the same work!

Ex-Cell-O Precision Cam Boring Machines use direct cam action on table and cross slide to perform an endless variety of boring and contouring work. To change the part form, the operator simply changes two convenient cams and tool blocks.

How many ways can you use a versatile boring machine like this in your work? Get the fact-story from your Ex-Cell-O Representative, or write direct for details on the complete line.





ABOVE: Operations are (1) generate track, (2) drill, (3) back chamfer and contour bore I.D., (4) face, chamfer and turn O.D., (5) chamfer O.D. and cut-off. LEFT: Style 308 Cam Boring Machine. FAR LEFT: Part (shown 2½ times actual size) is 440C stainless steel. Tolerance is held to plus or minus .00025", finish to 20 RMS.

60-28

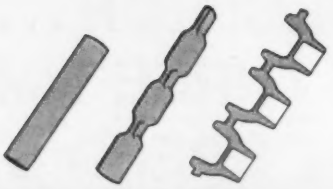
EX-CELL-O FOR PRECISION

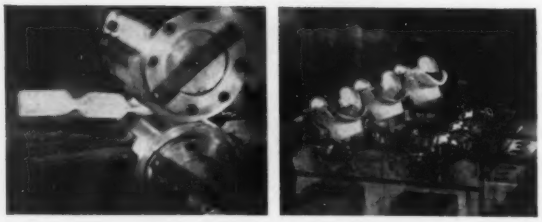
PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

REDUCEROLL + MAXIPRES = Modern Forging!



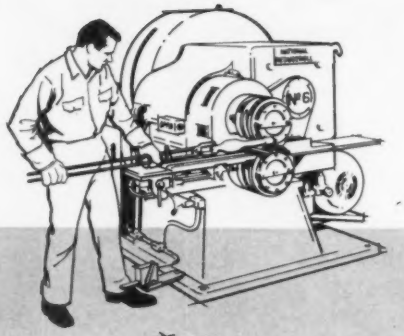


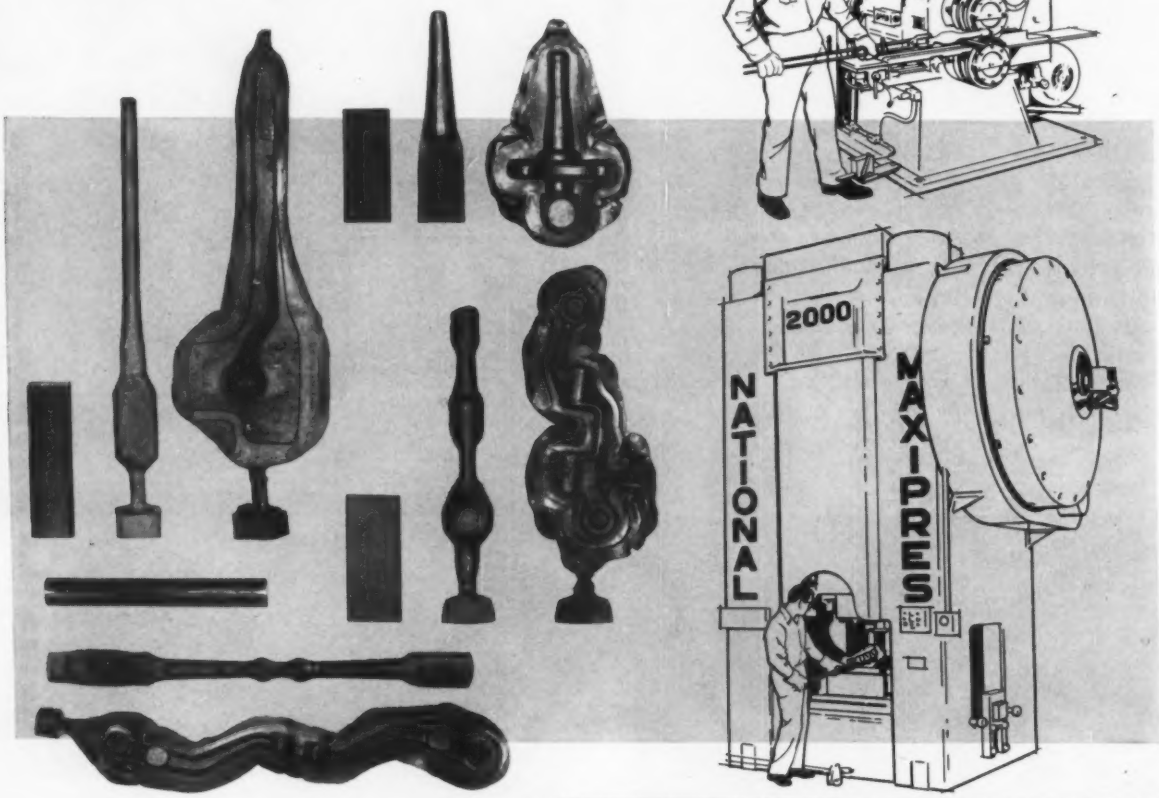
Modern forge plants around the world are using the method shown at right:

1. Prepare forging blanks in Reducerolls;
2. Finish forge in Maxipresses on the same heat.

Cost of making these forgings, and others, reduces by *one third* (even more!) thanks to modern engineering, latest-design equipment and proven methods.

Bring your prints or forgings to Tiffin. Let's discuss your plans for automatic or manual forging, but without obligation.





Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

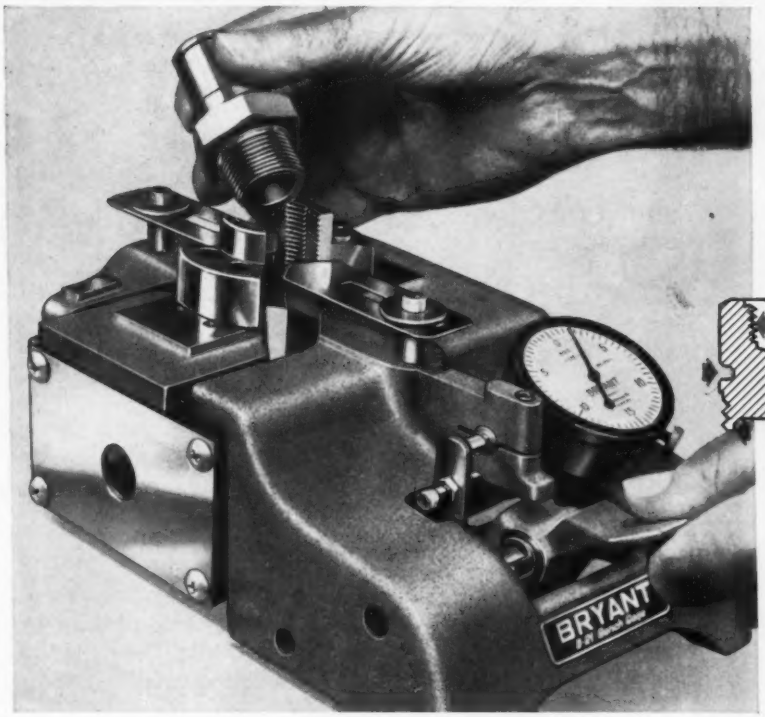
NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD **DETROIT** **CHICAGO**

For more data circle this page number on card at back of book

All these checks . . . with one Bryant Gage!



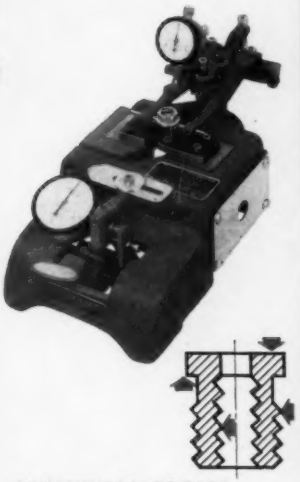
CHECKS THREADS, GROOVES AND BORES—Bryant B-21 Bench Gage checks parts with special grooves, snap-ring or O-ring grooves, or ID and OD threads in all classes to 5″ diameter—and does it 8 to 10 times faster than other methods! Stationary and movable gaging segments end the need to thread parts onto gage.

CHECKS SQUARENESS-OF-FACE—With optional Squareness-of-Face Attachment, the B-21 simultaneously checks thread size and true face run-out in relation to thread axis. Two models: One for parts up to 2″ face diameter, one for parts to 7″ face diameter. Attaches in seconds to the B-21 Gage.

CHECKS ID CONCENTRICITY—Attachment A-9081 quickly converts the B-21 to check concentricity of bores, grooves or special internal recesses in relation to OD threads or plain OD surfaces of parts up to 8″ diameter with up to 5″ nominal thread size.

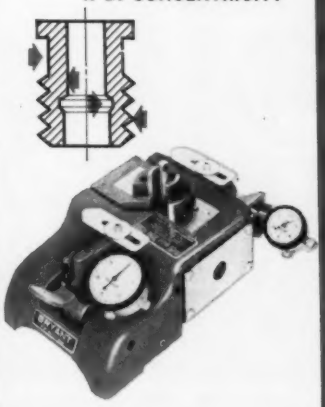
AND MORE—See your Bryant Gage Representative, or write for prices, engineering data, and bulletins on the standard and special accessories that make the Bryant B-21 Bench Gage indispensable to quality control throughout industry.

STANDARD B-21 GAGE



SQUARENESS-OF-FACE

I. D. CONCENTRICITY



61-42-B

EX-CELL-O FOR PRECISION

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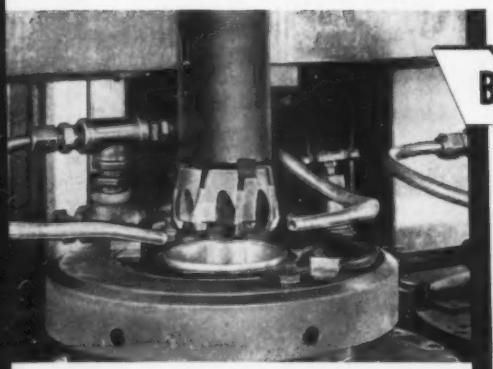
EX-CELL-O CORPORATION

Greenville Plant, 945 E. Sater St., Greenville, Ohio

FOR MILLING.

MILLING

By combining conventional Rigidcut and throw-away cutters on the same job, straddle milling valve bodies, Wesson cut cost from 83c to 21c per 100 parts, cut down-time, boosted production. (Wessonmetal GI used.)



BORING

Wesson Job-engineering cut steel cylinder sleeve boring time with carbides from 10 minutes to 20 seconds, multiplied pieces per grind 25 times, output per spindle 34 times. (Wesson ST 17272 cutter used with tipped Wessonmetal GI blades.)

TURNING

Wesson proved that cast steel armorplate could be turned with throw-aways at a saving of 43% in tip cost per piece. (T-A Holder and Wessonmetal HR carbide used.)

WESSON COMPANY •WESSON METAL CORP. •

...THROW-AWAYS or CONVENTIONALS?

make it easier to decide...

Two new advances in milling cutter design by Wesson . . . which makes BOTH throw-away and conventional cutters . . . now make it possible for throw-aways to do two things (see illustration at right):

- **eliminate the run-out problem, and**
- **produce extra fine finishes**

With these problems solved, it is a matter of what is best on your own jobs. Here is where the Wesson man can help you. He was picked for his milling, turning and boring know-how, for his experience in getting the most out of any milling cutter . . . conventional or throw-away.

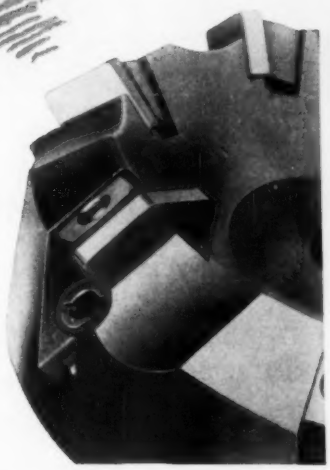
Let him work for results in your plant like those shown at the left . . . typical of what Wesson's in-plant service is doing for others. He costs you nothing. He's as near as your phone.

Back of his recommendations is the experience of the entire Wesson group of 4 specialized tool plants, plus Wesson's basic research, application research and tool engineering groups, plus its own carbide metals plant.

Don't forget Wesson offers another 'plus': grades specifically developed by Wessonmetal for milling with throw-aways and milling with conventionals.

To make it easier to decide, too, send today for Wesson's Booklet: "How to mill with conventional and throw-away cutters." It's quite a help.

Wesson Company, 1220 Woodward Heights Blvd., Ferndale 20, Michigan. In Canada: Wesson Cutting Tools Ltd., 93 Judge Road, Toronto 18, Ontario.



2 More New Wesson Developments

Ability to finish consistently to less than 50 microinches and finish mill without runout is now possible with the new Wesson throw-away cutters with one Micro-Finishing blade and adjustable tapered pins.

WESSON CUTTING TOOLS LTD. • WESSON PRODUCTS CO. • WESSON RESEARCH

WESSON

ARCHER & SMITH • WESSON MULTICUT CO.

For more data circle this page number on card at back of book

Diamonds machine ceramic parts

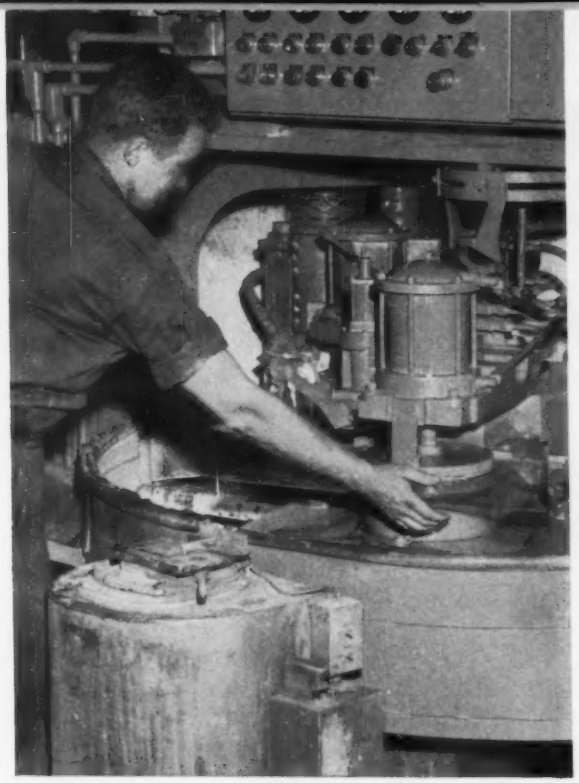
Diamonds polish dies for plastic dinnerware

EACH OF THESE JOBS IS NOW DONE BETTER AND CHEAPER WITH DIAMONDS

Other abrasives and cutting tools were once used to perform every job shown here. But it was found, in every case, that diamonds do the work better, last longer, are more economical than the old way.

These pictures prove the versatility of diamonds, too. Look at the different *kinds*

Diamonds remove bumps from concrete runways and highways



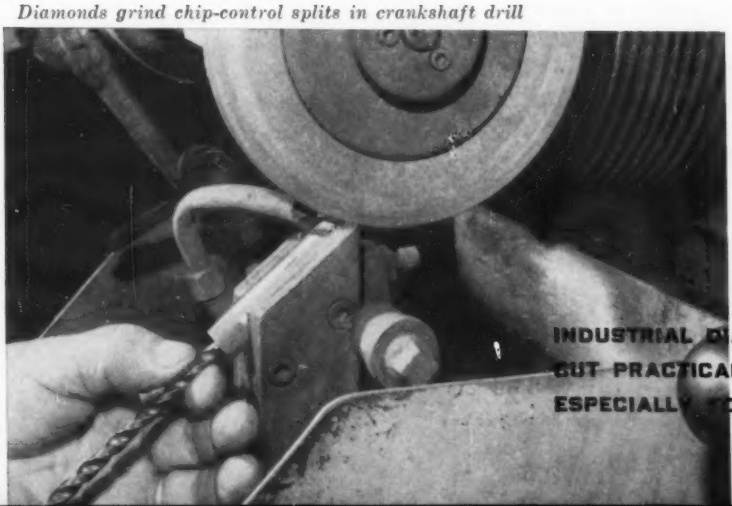
Diamonds edge automotive safety glass

of jobs they can do—everything from polishing the sensitively controlled dies that shape plastic dinnerware to shaving the bumps from a concrete jet runway.

If you cut, sharpen or smooth in your business, you can probably use diamonds to advantage. Next time you buy wheels or tools, ask for diamonds. Test them against the method you're now using. You'll find out how economical a diamond can be.

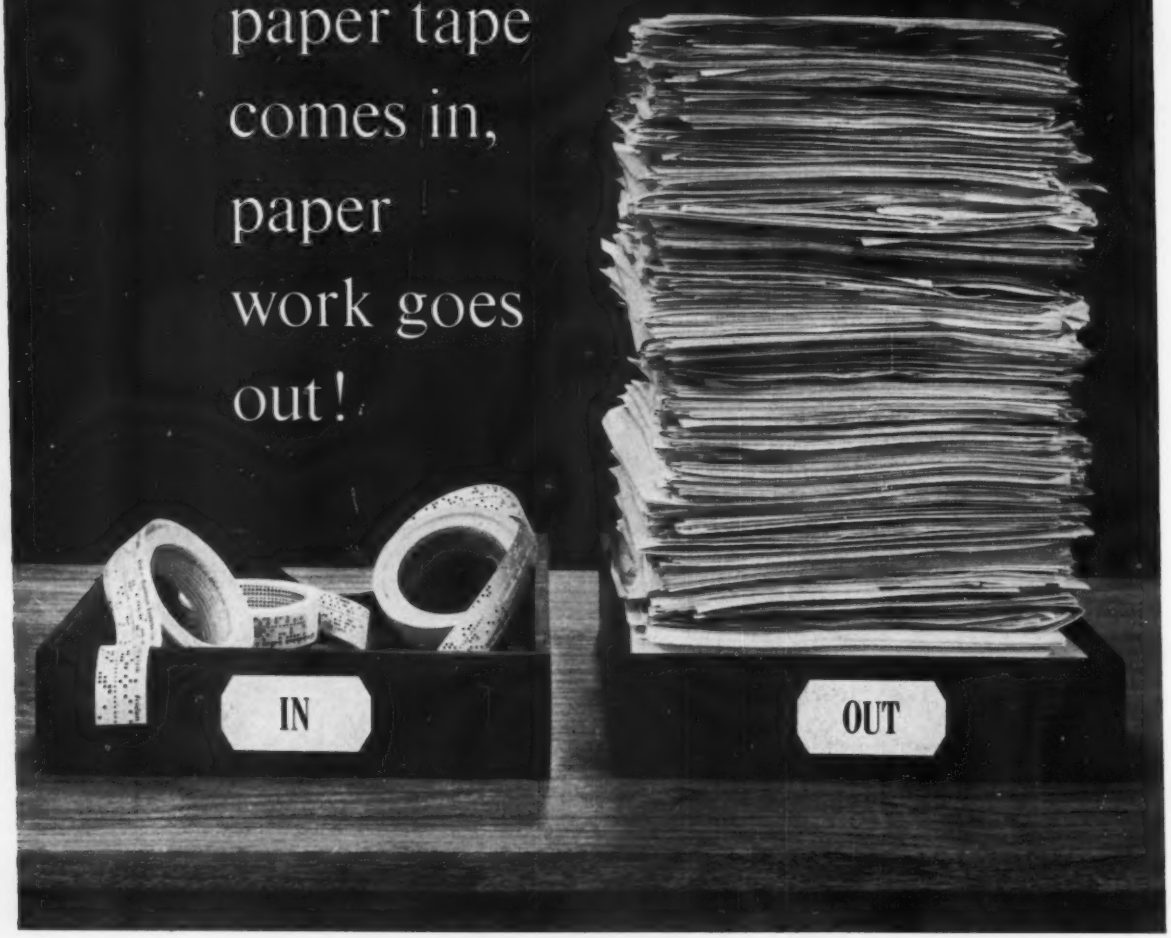
INDUSTRIAL DISTRIBUTORS (SALES), LTD.; LONDON

Diamonds grind chip-control splits in crankshaft drill



INDUSTRIAL DIAMONDS CUT PRACTICALLY EVERYTHING . . . ESPECIALLY YOUR PRODUCTION COSTS

Collectadata: when paper tape comes in, paper work goes out!



The machine at left is a Friden Collectadata® Transmitter, key to a new system of internal data collection that virtually eliminates in-plant paperwork.

The system is very simple. Transmitters, spotted in key reporting locations throughout the plant, are cable-connected to a central Collectadata Receiver. "Blank forms" are issued as pre-coded tab cards or Friden edge-punched cards. Each card becomes a "filled-in" report after the worker inserts it in the transmitter, dials in any variables and touches a key. The rest is automatic. The receiver records each report in punched paper tape, adds an automatic time code. At day's end, the receiver tapes are processed—converted to tab cards or fed into a computer to prepare complete operations reports.

Collectadata users report substantial savings in time and money. But in many applications the *speed, accuracy and efficiency* of automated data collection are even more significant. For information, consult your local Friden Systems Man. Or write: Friden, Inc., San Leandro, Calif.

THIS IS PRACTIMATION: automation so hand-in-hand with practicality there can be no other word for it.

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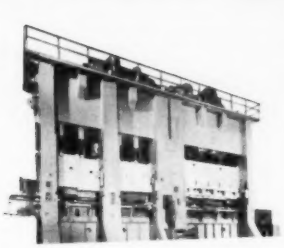
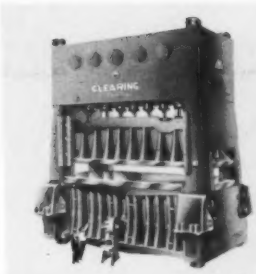
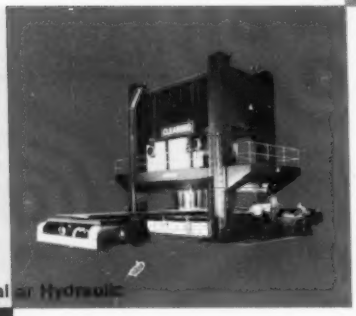
Friden

SALES, SERVICE AND INSTRUCTION THROUGHOUT THE U. S. AND WORLD

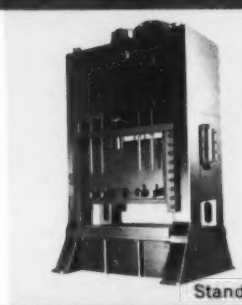


Large or Small

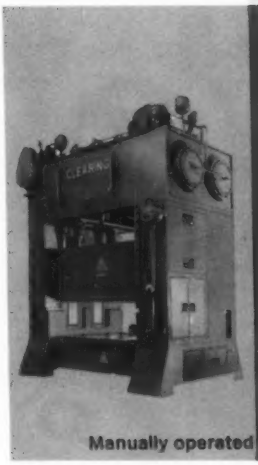




Mechanical or Hydraulic



Standard or Special



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CLEARING designs and builds all types of presses in order to furnish the RIGHT equipment FOR YOU

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of automotive vehicles in the en
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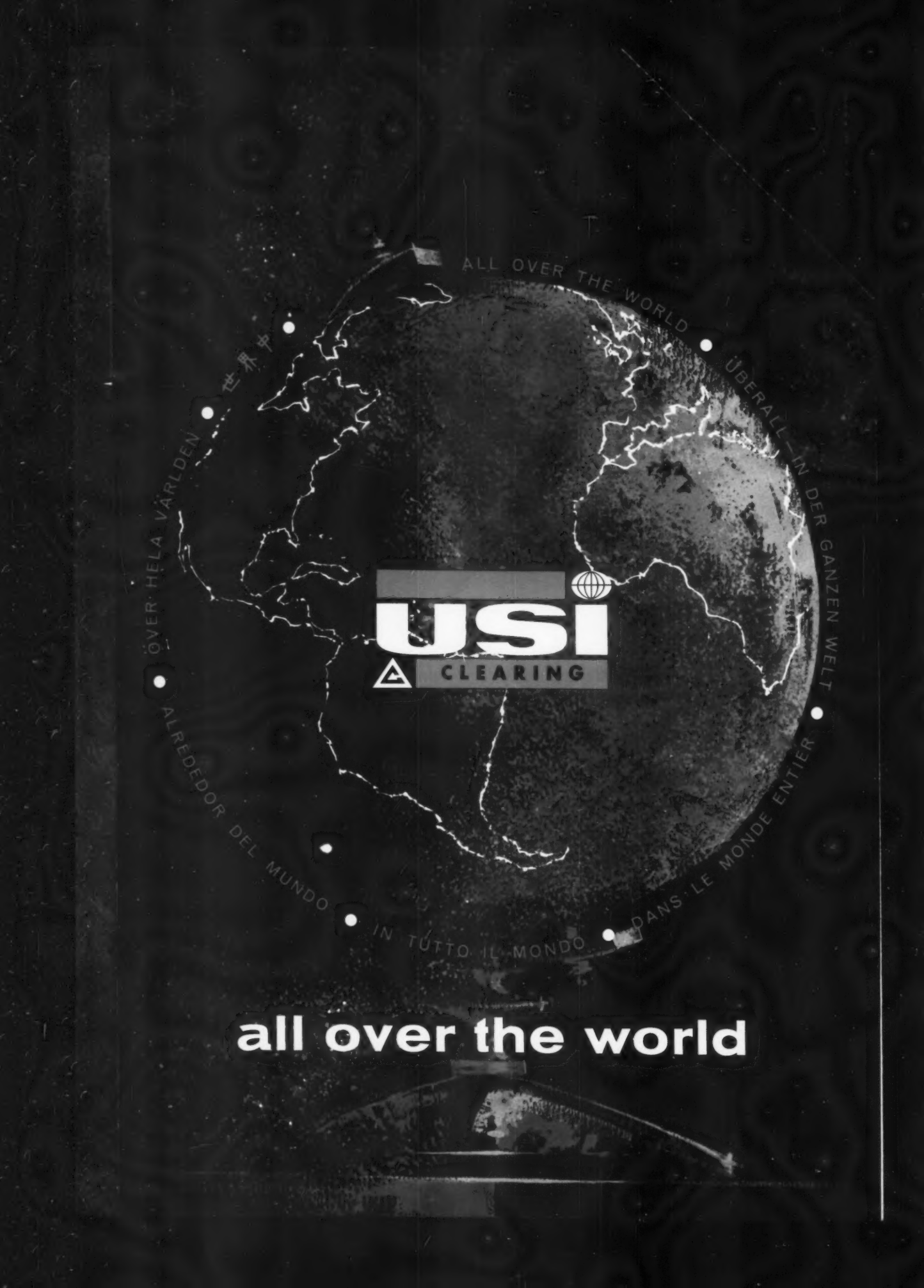
SSES.

Clearing engineers can help you hold the line on production costs too. We'd like to discuss the problem with you. Call on us at any time.

USI Clearing


ALL OVER THE WORLD
ÜBERALL IN DER GANZEN WELT
DANS LE MONDE ENTIER
IN TUTTO IL MONDO
ALREDEDOR DEL MUNDO
ÖVER HELA VÄRLDEN
USI
CLEARING
all over the world

FOURTH DAY DOWN... Until Cimplus took over!

Here's an actual case history of another plant that has discovered the remarkable qualities of rust-controlling CIMPLUS, transparent grinding fluid of the famous CIMCOOL family. (Company name on request.)

FIELD SERVICE REPORT

The job was grinding cast iron machine tool parts on three rotary surface grinders with an 1800 gallon central cutting fluid system.

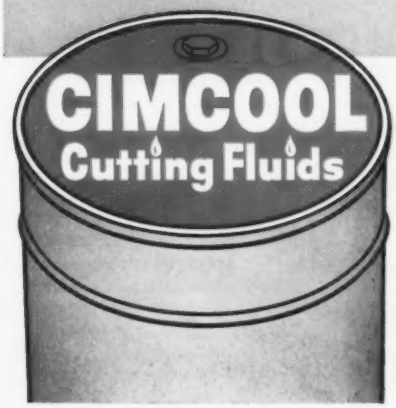
The coolant they had been using had let the sludge cake up and clog up the lines and they had been shut down for four days. Then we installed Cimplus at 100 to 1 dilution and the problem was solved.

Since Cimplus took over, they've had no sludge trouble at all. The swarf and grit settles nicely for them, but it doesn't cake. They're also real pleased with the rust prevention on the cast iron parts that Cimplus gives them.

Kent Reece

N. Y. Office

Page 2



FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

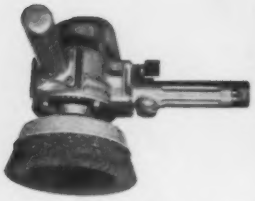
CIMCOOL 52 Concentrate — The pink fluid which covers 85% of all metal cutting jobs.
CIMPERIAL° — Newest in the famous, industry-proven line of CIMCOOL° Cutting Fluids.
CIMPLUS — The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS) — For every job requiring an oil-base cutting fluid.
ALSO — CIMCOOL Tapping Compound — CIMCOOL Bactericide — CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

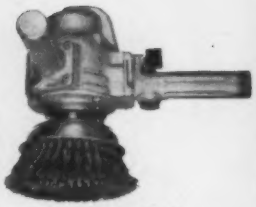
°Trade Marks Reg. U. S. Pat. Off.

For more data circle this page number on card at back of book

pick your production-proved Cleco Air Tool



Vertical Grinders



Vertical Wire Brush Machines

Drills

Screwdrivers

Screwdrivers

Nutrunners

Impact Wrenches

Die Grinders

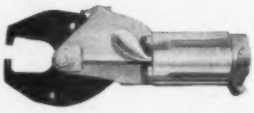
Horizontal Wire Brush Machines

Scalers

Scalers

Chippers

Riveters



Squeeze Riveters

Rammers

Paving Breakers

Clay Diggers

The tools pictured above are only a representation of the hundreds of Cleco Air Tools available.

For detailed information on Cleco's complete line of production-proved air tools and accessories, or for a demonstration-tryout, contact your local Cleco representative or write:

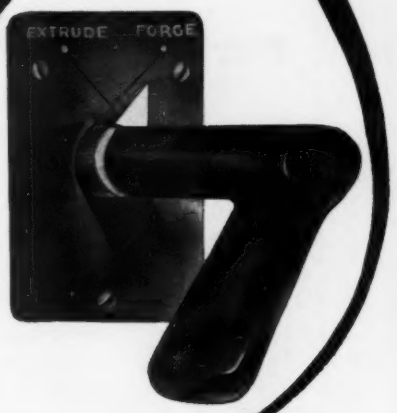
A Division of **Reed Roller Bit Company**
P. O. Box 2541 Houston 1, Texas, U. S. A.

Cleco Pneumatic Tool Company of Canada, Ltd.
927 Millwood Road, Leaside (Toronto), Ontario

"quality tools engineered for industrial progress"

CLECO
AIR TOOLS

Republic Steel does both... on **one** BIRDSBORO hydraulic press!



● A turn of a handle . . . and this 500-ton Birdsboro press forges *or* extrudes for Republic Steel's research center in Independence, Ohio. An interlocked hydraulic-electric circuit — designed and built by Birdsboro engineers — is the key to its unusual flexibility.

Used to explore the behavior of new metals, the press permits very high speeds . . . up to fifty 1″ forging strokes per minute, and 15″ to 150″ infinitely variable pressing speed per minute during the extrusion cycle.

Combining versatility with superior performance is only one of the many ways Birdsboro's custom-built presses can save you space, time and money. Can we tell you the others? *Sales Department:* Reading, Pa., *Engineering Department and Mfg. Plant:* Birdsboro, Pa. *District Office:* Pittsburgh, Pa.

HP45—60

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CORPORATION BIRDSBORO, PENNA.

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • ROLLS • ELECTRIC STEEL CASTINGS: Carbon, Low Alloy and STAINLESS STEEL

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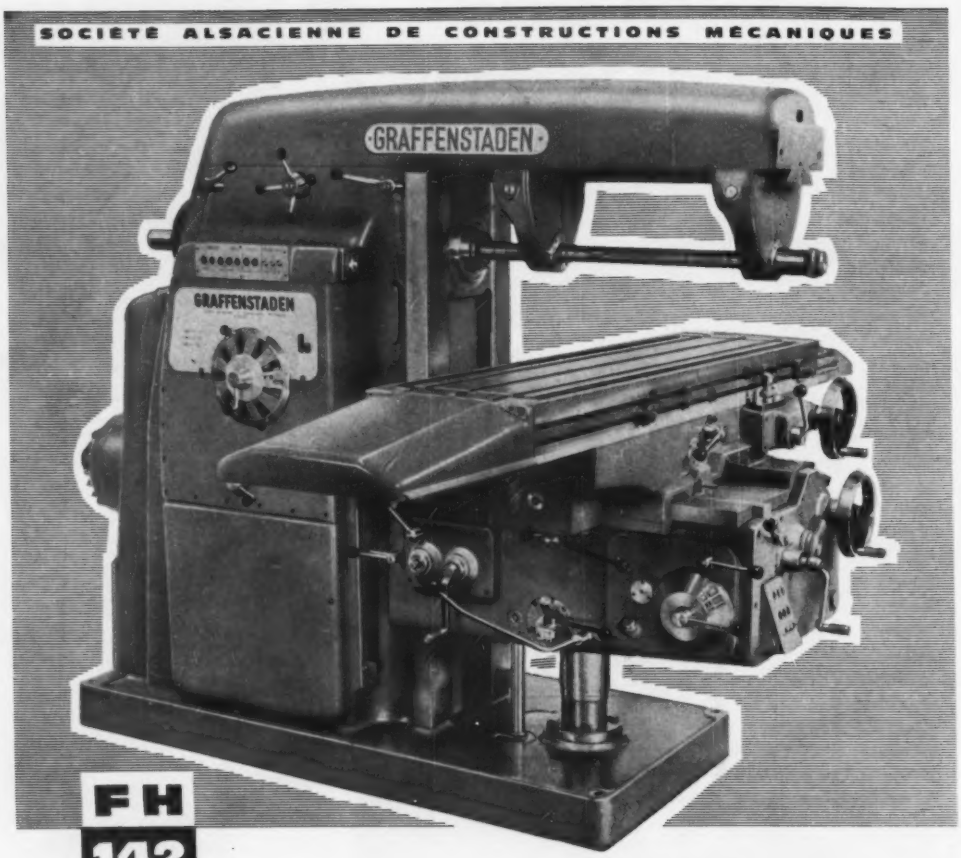


FH 142

HEAVY DUTY HORIZONTAL MILLING MACHINE

SPECIFICATION

Table surface	480 x 1940 mm	(18.9 x 76.5")
Longitudinal travel of table	1400 mm	(55")
Transverse traverse of table	450 mm	(17.7")
Total installed power	37 HP	
Approximate net weight ...	7.3 tons	

- Automatic cycle for longitudinal table traverse
- Backlash eliminator to longitudinal leadscrew for "up" and "down" milling
- Dual control

OTHER PRODUCTS

GRAFFENSTADEN

Universal combination millers
Knee table milling machines
Bed type millers
Base type production millers
Planer type milling machines
Radial boring machines
Single column vertical boring mills
Boring and milling machines
- table type
- floor type
- planer type

Ram-type milling and boring machines

GRAFFENSTADEN WORKS (BAS-RHIN) FRANCE
For more information, write to S.A.C.M., 3 Channing Place, Cambridge 38, MASS., Tel. EL. 4-8043

A sample equipment analysis form from

Diamond Chain

Here the MAPI approach to capital-equipment investment analysis is used as an essential element in equipment replacement for maintaining efficiency in the production of high-quality products.

In January, 1959, this page carried a statement by the Diamond Chain Company, Inc., Indianapolis, Indiana, which, in part, was as follows:

"We consider a formal procedure for the justification of capital equipment investments to be an essential element in our constant effort to increase productivity and improve the quality of our power transmission products and the working conditions under which they are produced."

In connection with the sample analysis form shown here, Mr. H. N. Cottingham, President and General Manager, states:

"One of the significant benefits of the application of the MAPI approach to investment analysis has been the improved examination and expression of the initial proposals for new equipment by factory supervisors and others.

"Proposals, with supporting data, are received from every segment of our organization and referred to our Industrial Research and Development Division for further investigation. Detailed studies are made to establish the acquisition and operating costs for uniform establishment of economic worth and rating as shown in this example."

FORM 4307 DIAMOND CHAIN

EQUIPMENT ANALYSIS

LINE			
1	SUBJECT OF ANALYSIS	CONVERSION FROM BATCH TO CONTINUOUS TYPE CARBURIZING.	
2	ASSUMED RATE OF PRODUCTION	474,000 Pounds Per Year	
3		A PRESENT EQUIPMENT	B PROPOSED EQUIPMENT
3	DESCRIPTION	J-Hearth Furnaces	Single Retort Continuous Furnace
4	DEPARTMENT 27 / MACHINE NUMBER	4223, 25, 26	ESTIMATED SERVICE LIFE 15 / TERMINAL SALVAGE $ 9700
5	COST OF UNIT $ 64,910	INSTALLATION $ 10,704	TOTAL COST $ 75,614
6	SALVAGE VALUE OF RETIRED ASSET TAX ADJUSTED	$ 350	
7	CAPITAL ADDITIONS REQUIRED WITHOUT PROJECT	$ 0	
8	INVESTMENT RELEASED OR AVOIDED BY THE PROJECT (6 & 7)		$ 350
9	NET INVESTMENT REQUIRED (5-8)		$ 75,264

LINE	NEXT-YEAR COSTS	A PRESENT	B PROPOSED
11	EFFECT ON REVENUE	$	$
12	SUPERIORITY OF PRODUCT	—	—
13	INCREASED OUTPUT	—	—
14	OTHER	—	—
15	OPERATING COSTS		
16	DIRECT LABOR	58,800	6,660
17	INDIRECT LABOR	—	—
18	SETUP TIME	—	—
19	MAINTENANCE & REPAIR	1,513	2,005
20	TOOL & SUPPLY COSTS	1,370	4,539
21	REWORK & SCRAP	—	—
22	POWER CONSUMPTION	2,425	4,757
23	FLOOR SPACE	4,600	1,920
24	PROPERTY TAX & INSURANCE	—	1,498
25	SUBCONTRACT COSTS	—	—
26	OTHER Boxes & Retort	7,300	3,407
27	TOTALS	$ 76,010	$ 24,786
28	NEXT YEAR ADVANTAGE (27A-27B)		$ 51,224
29	NEXT YEAR ALLOCATION FOR CAPITAL ADDITIONS		$ 0
30	TOTAL NEXT YEAR ADVANTAGE (28 - 29)		$ 51,224
31	TOTAL NEXT YEAR ADVANTAGE AFTER INCOME TAX (30x50%)		$ 25,612

32	ITEM OR GROUP	A INSTALLED COST (ITEMS) $	B EST. SERVICE LIFE (YEARS)	C EST. TERMINAL SALVAGE %	D MAPI CHART NUMBER	E CHART PERCENTAGE	F CHART % x COST (COL. E x COL. A) $
	CAPITALIZED	74,910	15	15	1	3.6	2690
	EXPENSED	704	15	0	18	1.8	126

33	TOTAL MAPI CHART ALLOWANCE FOR PROJECT (32F)		$ 2,816
34	AMOUNT AVAILABLE FOR RETURN ON INVESTMENT (31-33)		$ 22,796
35	MAPI URGENCY RATING (34 ÷ 9) X100		30 %
36	ANALYSIS BY H. WILLOUGHBY	APPROVED H.N.C.	DATE 10-15-58

DIAMOND CHAIN COMPANY, INC.
INDIANAPOLIS, INDIANA

Keep gathering metalworking production ideas . . .
be well informed when you replace machinery.

ROCKFORD INSERT GROUP

New method hikes production 50% over conventional grinders: **Stock-removal** surface grinding . . . with new Mattison No. 60. Up to 150 hp. Rigid box-type construction. Capacities to 90 in.

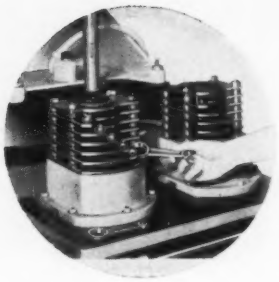
How to combine perfect flatness with high productivity in one operation: Automatic spindle tilting. Rough grind on leading edge of wheel. High downfeed and hp increase grain penetration and stock removal—keep wheels self-dressing. Flick of switch returns spindle to vertical for fast finish grind. Perfect flatness on every job. Ask your Mattison dealer.

MATTISON MACHINE WORKS
Rockford, Illinois

Fast stock removal, perfect flatness, economically!

MATTISON
MACHINE WORKS
ROCKFORD, ILL. U.S.A.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



QUALITY FOR YOUR PRODUCTS STARTS HERE

What better way to guarantee high quality products than to hone them on precision BarnesdriL Honing Machines!

New from top to bottom . . . these machines incorporate every advanced feature gleaned from our 35 years of honing experience.

Greater ruggedness . . . a broader range of capacities . . . more compact design . . . easier maintenance — these are plus-features inherent in every BarnesdriL machine to give you precision control at cost-cutting production speeds.

Our new catalog No. 200 gives complete details. Write for your free copy today!

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BARNES DRILL CO.

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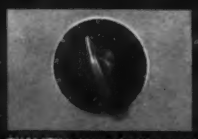
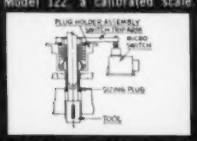
DETROIT OFFICE • 13121 PURITAN AVENUE



QUALITY is insured with correct hone feeds . . . made possible with this easy-to-set infinite hone feed control.

QUALITY at high-production rates means exact spindle speed rates . . . selected with a flick of the fingers.

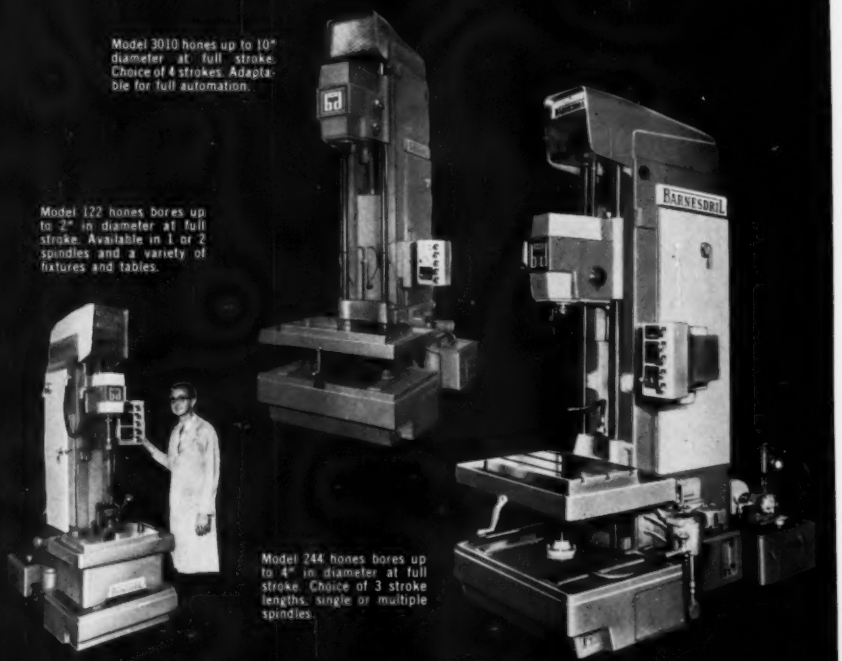
QUALITY results from correct reciprocation speeds . . . easily selected with this dial or, on the Model 122, a calibrated scale.



QUALITY is automatic with Plugmatic bore-to-bore sizing . . . production size consistency maintained to .0002".

Model 3010 hones up to 10" diameter at full stroke. Choice of 4 strokes. Adaptable for full automation.

Model 122 hones bores up to 2" in diameter at full stroke. Available in 1 or 2 spindles and a variety of fixtures and tables.



Model 244 hones bores up to 4" in diameter at full stroke. Choice of 3 stroke lengths, single or multiple spindles.

OUR FULLY EQUIPPED JOB HONING DEPARTMENT CAN HONE ANYTHING UP TO 25 FEET IN LENGTH. WRITE FOR DETAILS!

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Here is one of the most promising machine tool developments for general-purpose gear cutting in the history of modern hobbing.

61%

. . . on New

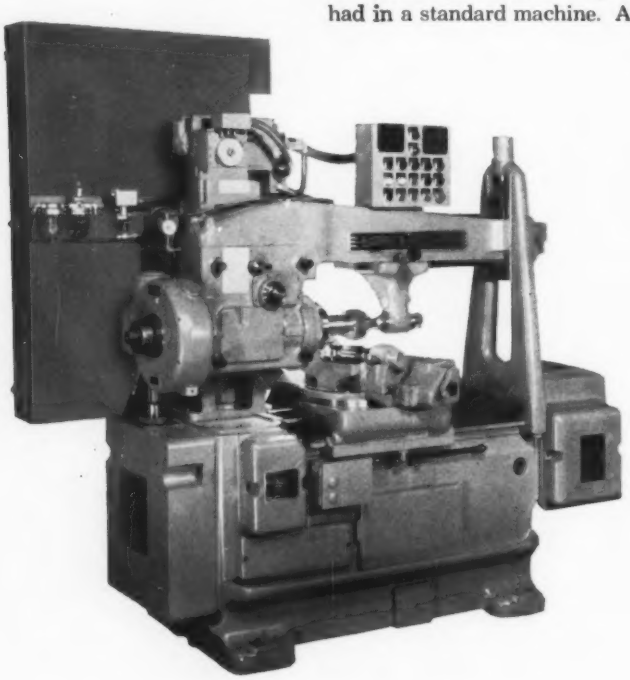
Now, faster production through reduced cutting time and easier setup is a practical reality for a wide range of work. Barber-Colman's new No. 16-16 multicycle machine reduces nonproductive machine time greatly. Job studies noted on the opposite page are typical of what you can expect without a change in material specifications or hob life. Annual savings for the full range of work produced on this machine would show a significant increase in profits.

Whatever you save is net gain

Hobbing worm gears, splines, helical gears, or spur gears—in 1- or 100-piece lots—you can trim valuable minutes from cycle time without sacrificing finish or hob life. The larger the hob, the more time you save—because nonproductive approach usually can be reduced considerably with the plunge-approach cycle.

This is automatic hobbing at its best, with power vertical feed and conventional horizontal feed—also with more real versatility than you ever had in a standard machine. Any of three automatic cycles can be chosen by turning a switch.

1. *Square cycle*—automatic version of conventional hobbing cycle, with rapid positioning of workslide and rapid return of the hob carriage.
2. *Plunge cycle*—automatic vertical feed, with infinitely variable downfeed and rapid positioning of the workslide.
3. *Plunge-approach cycle*—combination of the above to provide shortest possible approach to full depth.



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

MORE GEARS

Multicycle Hobbing Machine

Once setup is completed, the operator loads, presses the start button, and unloads manually. The big difference is in the way the hob and work are positioned—faster, accurately, automatically, and in the most direct manner.

In reviewing these possibilities for your plant, consider the added advantage of variable downfeed. A worm gear job formerly was done on a conventional machine. With a feed rate of .007″ per revolution, followed by a four-revolution dwell, and with a hob speed of 103 rpm, floor-to-floor time was 4.83 minutes.

The same job on the multicycle is done in 3 minutes, floor to floor. Setup time has been reduced from 67 minutes to 55 minutes.

Part of this saving results from constantly variable vertical feed. This provides a high feed rate at the start of the cycle when chip load is light . . . light feed at full depth when chip load is heavy. The *average* feed of .018″ per revolution is more than double that used on the change-gear-type machine.

Multicycle machines are now in production in both the Nos. 6-10 and 16-16 sizes. Call your Barber-Colman field representative or write the factory for delivery information.

Barber-Colman Company

BARBER COLMAN

32 Loomis Street, Rockford, Illinois

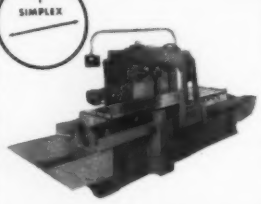
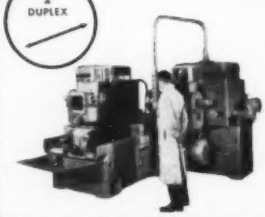
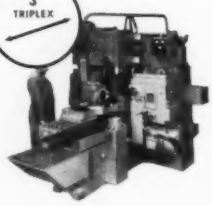
TYPICAL SAVINGS WITH MULTICYCLE HOBBING

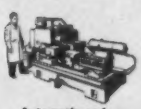
JOB FACTS	Cast Bronze Worm Gear		Cast Iron Spur Gear (shown at left)	
	Conventional (Vertical Feed)	Multicycle (Variable Feed)	Conventional	Multicycle (Plunge Approach)
Hob speed (rpm)	103	120	246	246
Horizontal feed (ipr)	....	....	.060	.060
Vertical feed (ipr)	.007	.018 (average)	....	.030
Approach Distance (in)	....	....	.700	.360
Dwell	4 rev.	24 seconds	....	....
Pieces per hour	12.42	20	6.94	8.68
Setup time (min.)	67	55	85	85
Production increase		61%		25%

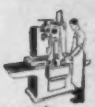
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

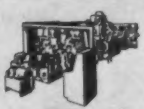
AN EXAMPLE: This Sundstrand Rigidmil with a vertical and a horizontal spindle combines two operations on turbine diaphragms and saves 25% of its original cost annually. The two operations are machining of flat surfaces where the diaphragm halves are joined, and milling of special keyways, the latter performed by the vertical spindle of the Rigidmil. On some sizes of diaphragms, this machine is saving four setups and 26 crane lifts as compared with the machines formerly used for the work.

custom milling machines *from* standard components

	1 SIMPLEX	2 DUPLEX	3 TRIPLEX
			
HEADS	3 to 100 hp | HORIZONTAL or VERTICAL	3 to 100 hp | HORIZONTAL or VERTICAL	3 to 75 hp | HORIZONTAL and VERTICAL
TABLES Width"	10½ to 96"	10½" to 38"	10½" to 38"
TABLES Feed Stroke"	18" to 216"	18" to 216"	18" to 216"
COLUMNS	FIXED OR CROSS TRAVEL	FIXED OR CROSS TRAVEL	FIXED OR CROSS TRAVEL
CONTROLS	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT


Automatic and Tracer Lathes


Milling Machines


Transfer Machines

Multiple-spindle Drilling Machines

Belt and Wheel Grinders

Broaching Tools

Broaching Machines

Thread Milling Machines

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Sundstrand offers you "Engineered Milling Production" with a standard machine line

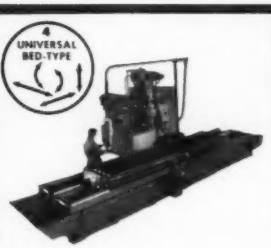
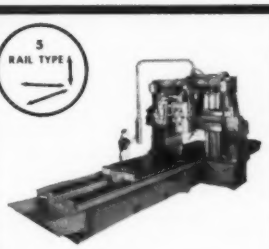
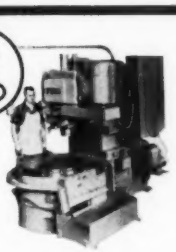
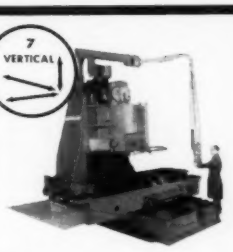
Unit construction provides almost unlimited arrangements, "custom-built" to meet your specific needs

The Sundstrand "Engineered Production" approach to your milling requirements assures you maximum productivity per dollar of machine investment. Sundstrand application engineers evaluate your production and then recommend a machine that will fit your requirements as if it were specially built for the job. This is possible because of the exceptionally wide range of Rigidmil sizes, types, and unit combinations available, as indicated in the table below.

For example, Sundstrand catalogs more than 138 standard Simplex and Duplex machines, plus a wide range of variations. Attachments such as vertical feed to horizontal heads, power feed to quills, automatic index bases, etc., provide additional cycle combinations.

The heads, columns, and tables on C-model Rigidmils are self-contained units, permitting interchangeability through several sizes. There is no need to compromise when you need a machine that isn't quite a standard model, nor do you have to buy more machine than you need. Adding the next size head or table can give you a custom-built installation at minimum cost. And you get extra protection against obsolescence because if your work requirements change, you can modify the machine by changing the head.

To determine how much the right Sundstrand milling machine can save you, send for Bulletin No. 625 and ask about a Sundstrand "Engineered Production" analysis of your production.

4 UNIVERSAL BED-TYPE	5 RAIL TYPE	6 ROTARY TABLE	7 VERTICAL
			
20 and 50 hp | ALL ANGLE and HORIZONTAL	25 to 50 hp | VERTICAL	25 hp | VERTICAL	50 hp | VERTICAL
24" to 38" 48" to 216"	24" to 60" 48" to 216"	Dia. 36", 48"	30" 96"
CROSS TRAVEL	FIXED	FIXED OR CROSS TRAVEL	FIXED
PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE

SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

MACHINES DESIGNED WITH THE FUTURE IN MIND

PRODUCTION MACHINERY

GREENLEE

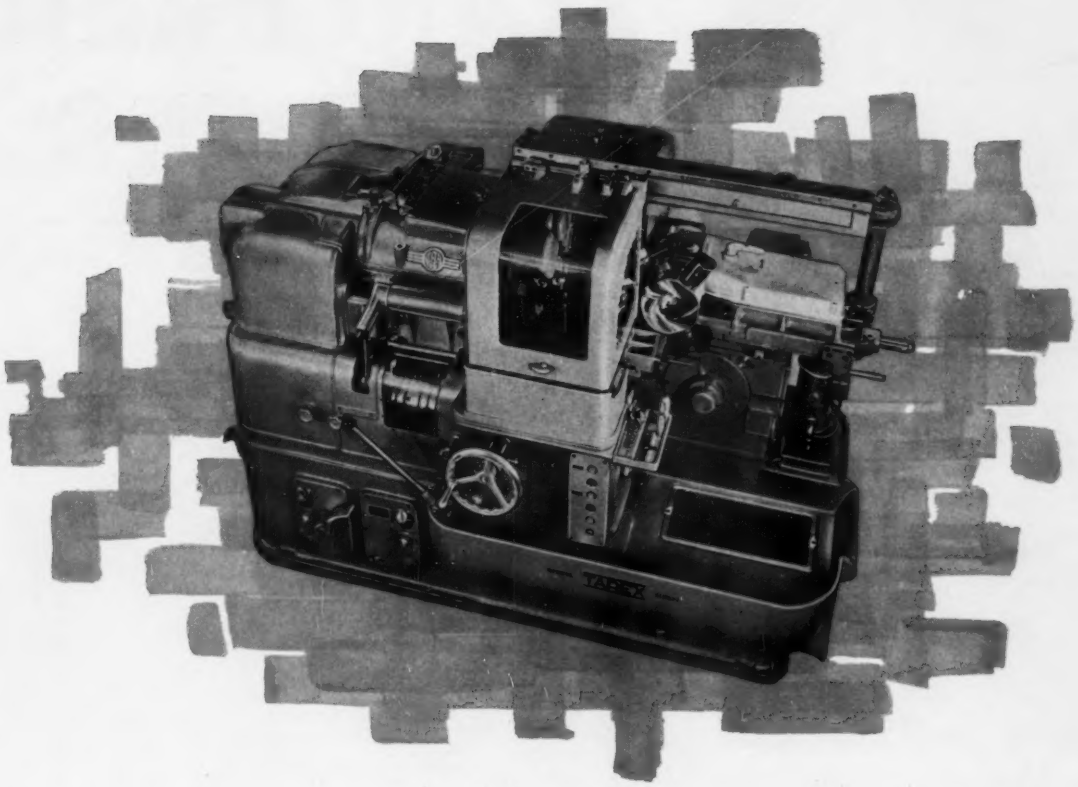
- Special Purpose Machines
- Transfer-Type Processing Machines
- Multiple-Spindle Drilling and Tapping Machines
- Six and Four-Spindle Automatic Bar Machines
- Die Casting Machines
- Trim Presses
- Woodworking Machines and Tools
- Hydraulic and Hand Tools

COOPERATIVE TEAMWORK MAKES THE DIFFERENCE

Through every phase of the construction of a Greenlee transfer machine, Greenlee engineers maintain a close contact with you, the customer. They are strong on the buyer's viewpoint . . . know what cost-conscious management wants. They stay on the job from the time of initial planning until your machine is operating at full efficiency. This last phase—the proving out period—is especially important. Greenlee men are extremely helpful in bringing your machine up to full production . . . training your operators to keep it producing profitably Call Greenlee. Let them show you how cooperative teamwork can benefit you.

GREENLEE BROS. & CO. 1943 MASON AVE. ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



Why The TAREX *Can Do Things No Other Machine Can Do*

Because the TAREX is a Swiss single spindle automatic, designed and engineered for the production capacity of a **turret lathe with**

added capacity—for chuck and bar work with the same universal spindle

added precision—short spindle construction, chainless direct drive

added versatility—ingenuously designed exclusive Tarex extra capacity attachments

greater production—much higher rpm than comparable machines

better finishing—sturdier construction

and many other plusses you should investigate.

There is a TAREX for almost every purpose from ¾" to 3½" of bar and 8" dia. of chuck work.

Ask for a demonstration

Prompt TAREX service available—complete stock of spare parts. Engineered for production, serviced with Swiss thoroughness.

Submit your machining problem with blueprints for analysis and our recommendations.

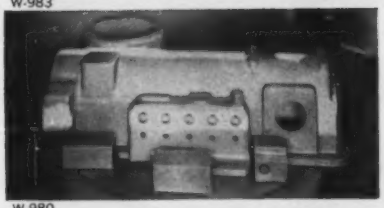
Exclusive U. S. Representatives

THE ARTHUR LOEFFEL COMPANY, INC.

MERRICK, N.Y. • TEL. FREEPORT 9-8600 Offices in Chicago and Los Angeles

For more data circle this page number on card at back of book

W-983



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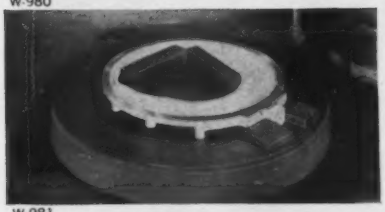

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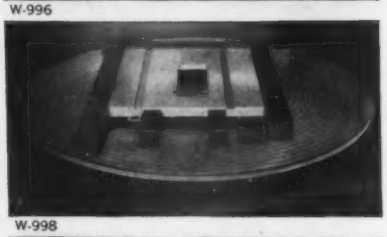

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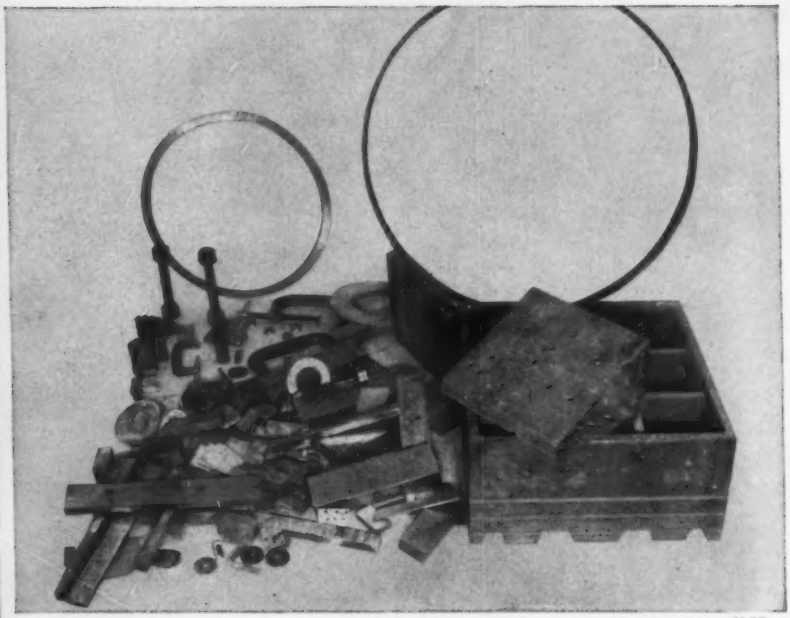
BLANCHARD GRINDERS



M-59

Use Industry's Least Expensive Fixtures . . .

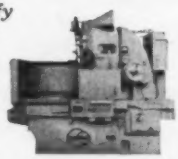
Normally, the Blanchard magnetic chuck will hold ferrous work pieces during the grinding cycle.

But when fixtures *are* needed — for holding irregular-shaped objects, whether ferrous or non-ferrous — you can usually select your "fixtures" from the nearest scrap pile.

For high-speed production, close-tolerance finishes and the most versatile grinding capabilities in existence . . . *put it on the Blanchard!*

Write today for your free copy of "Work Done on the Blanchard", Fifth Edition, and "The Art of Blanchard Surface Grinding", Fourth Edition.

For Best Results, Always Specify Blanchard Grinding Wheels for Blanchard Grinders.



No. 18

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 State Street, Cambridge 39, Massachusetts

Talking About Die Sets

with

Phil Marsilius

Executive Vice-President
The Producto Machine Co.

Die Set Maintenance in the Pressroom—The vital die-maintenance procedures required periodically when a die is removed from the press for sharpening should be coupled with systematic die set inspection and maintenance in the pressroom.

In addition to having a planned schedule of lubrication (based on any of the methods previously discussed in this space), you can make sure of getting the most out of your investment in die sets—and the costly dies and presses with which they are used—by following a simple set of procedures for inspecting and maintaining die sets in the pressroom.

Although there are no hard-and-fast rules that can be established for all die sets, the procedure listed below is generally followed at leading stampings plants in the East. These companies point out that die sets used in the cutting of extremely thin material or for very critical parts would naturally require a more stringent inspection than those used for blanking heavy material or for comparatively simple parts.

At one plant, specializing in long runs of close-tolerance parts for the electronics industry, the procedure followed is:

1. No inspection of the die set during production run unless, of course, there is overheating, pick-up on the guide pins or other obvious difficulties.

2. When the die is taken off the press for sharpening or maintenance, the die set is visually inspected for pick-up or score marks on either the guide pins or bushings. Pins and bushings are carefully cleaned to remove excess lubricant.

3. After approximately 1,500,000 strokes, the set is thoroughly checked for wear on both the pins and bushings. On the average, up to .0003″ wear on pins and bushings is allowed before replacement with new components is scheduled. In addition, the die set is placed on a surface plate and an indicator is placed over one end of the set. An attempt is then made to rock or twist the set by hand to establish how much the die set can be deflected. On a 10″ set, a maximum of .005″, but usually less, total deflection is allowed.

Because the die set plays such an important part in prolonging the accuracy and lifetime of a die, it pays to take the little extra time required to do justice to die set maintenance in the pressroom.

4. During regular or periodic regrinds, the die set is not checked for bent or distorted punch and die holders unless the die has been damaged or there is reason to believe the set may have warped.

During the overall period, if the pins and bushings are replaced, the punch and die holders themselves are checked for warpage or distortion. If necessary, these components are reground prior to assembling the new pins and bushings.

Why the pressroom foreman prefers Producto die sets

Four-stage blanking and shaving die, Lenkeit Machine & Tool Co., Inc.

They keep his downtime down

Keeping production *up* and downtime *down* is the main job of the pressroom foreman. He knows Producto die sets can help him do this job successfully because they maintain accuracy for long runs. All catalog steel sets are annealed to prevent distortion.

He is aware that Producto can provide him with any type of die set he needs—whether for standard or special presses—in a wide range of sizes and thicknesses, with or without clamping flanges.

The pressroom foreman knows that Producto guide pins are mirror-finished to eliminate scoring, and that Producto die sets are available with a variety of lubrication devices to keep them "running cool".

He knows, too, that he is not restricted to the use of predetermined press stroke or shut height because Producto offers an unlimited choice of pin and bushing lengths. Moreover, he can get the bolster he needs to protect his die at the same time he gets his die set. Both die set and bolster can be ordered in steel or cast semi-steel depending on strength requirements.

The pressroom foreman realizes that Producto Qwik-Fit Die Sets make "take-apart-and-put-together" easy during die maintenance. He also knows that Qwik-Fit removable pins and clamp-type bronze bushings are available when the application calls for them.

He can *produce more* with Producto die sets. So can you.

A WEALTH OF DIE SET KNOWLEDGE is packed into Producto's Catalog No. 11 and regular issues of *Die Set Digest*. Write today for these free aids.

THE PRODUCTO MACHINE COMPANY
984 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

For more data circle this page number on card at back of book

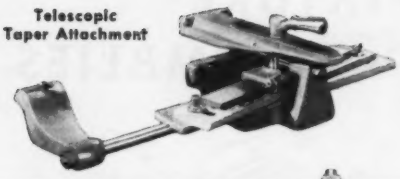
Like Other True Thoroughbreds...

Just as the blood lines in a superior race horse are recorded for posterity — so the Pipe Machinery Company keeps a complete and permanent register of "specs" on all their Solid Titanium Carbide Thread Ring Gages.

Manufactured to an amazingly high degree of accuracy, these sturdy Pipe Machinery thoroughbreds require their own special mating HILO type wear check plugs. They, too, are numbered and registered for your convenience.

Find out today how Pipe Machinery Titanium Carbide Thread Ring Gages can reduce your scrappage, speed up your inspection, insure the "assemble-ability" of your product. Write for further details on your company letterhead.

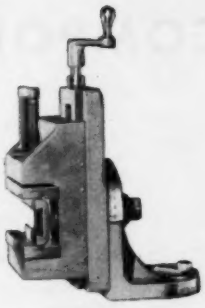
THE PIPE MACHINERY COMPANY 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland



Telescopic Taper Attachment

Ball Bearing Live Centers

Follower Rest



Milling Attachment

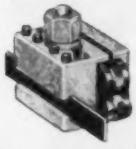
External Grinder

Steady Rest

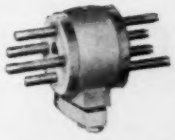
Handlever Collet Attachment

Handwheel Collet Attachment

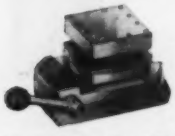
Collets



10-IN-1 Tool Holder



4-Position Carriage Stop

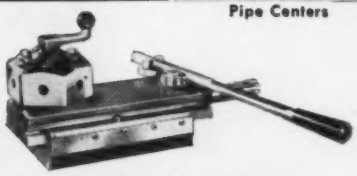


Square Turret Tool Block

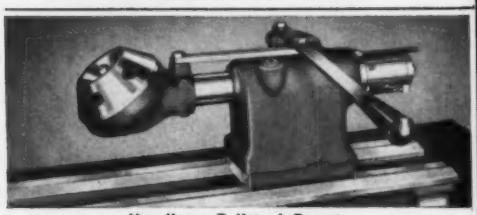
Cutter Bit Grinding Block

Swivel Machine Vise

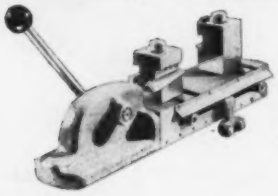
Pipe Centers



Handlever Bed Turret



Handlever Tailstock Turret



Handlever Double Tool Cross Slide

SOUTH BEND

ATTACHMENTS

help you get more work out of your machines

- CUT MACHINING TIME
- SIMPLIFY DIFFICULT JOBS
- SPEED UP TOOLING
- HANDLE MORE TYPES OF JOBS

SOUTH BEND LATHE, INC., South Bend 22, Ind.
Builders of Lathes, Milling Machines, Shapers, Drill Presses and Pedestal Grinders

SOUTH BEND

SOUTH BEND LATHE, INC., South Bend 22, Ind.
We would like to know more about all 212 South Bend Machine Tool Attachments.

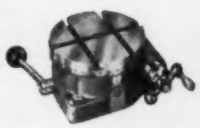
Name_____ Title_____

Company_____

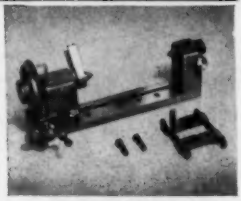
Street_____

City_____ Zone____ State_____

Universal Table



Rotary Indexing Table



Indexing Centers

For more data circle this page number on card at back of book

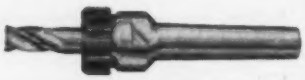
UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

213

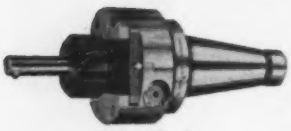
OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck



Standard Collet Chuck

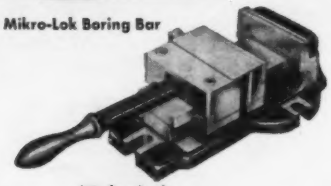
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 2, MICHIGAN

GRIND MORE METAL FOR LESS MONEY WITH MACKLIN *"wheels of profit"*

Whether you want fast stock removal or a micro-inch finish, for tool and cutter grinding, carbide grinding, for cutting-off, or snagging, for surface or disc grinding, for cylindrical or centerless grinding, you get efficiency and savings with Macklin "Wheels of Profit".

That's because uniformity is built into every wheel in Macklin's complete line. You get precise balance, cool and free cutting, and longer wheel life with a Macklin wheel that's "Custom-Engineered" for the job.

If you're having production problems on present applications, new setups, or your quality control, consult a Macklin abrasive engineer about a demonstration in your plant. You can contact him through your Macklin Distributor or call us direct. You'll find this a most effective way to improve your grinding production, and your call or letter will bring prompt response.

Guard removed for purpose of illustration.

MACKLIN company

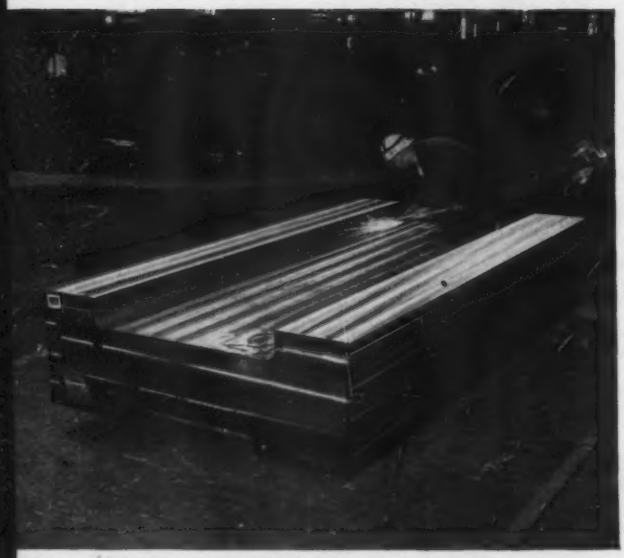
DEPARTMENT 14 JACKSON, MICHIGAN

Circle Page 55 on Card

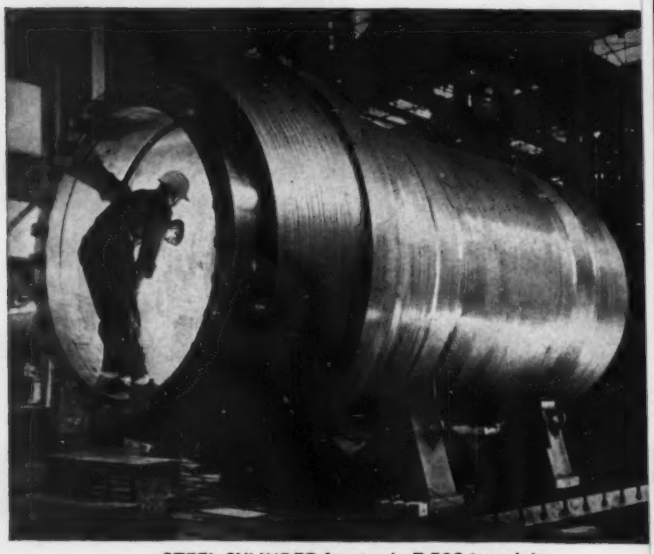
You name it...we'll forge it!

RIGHT ON THE NOSE. Bethlehem meets your specifications exactly on all types of press, drop, and hammer forgings.

for Strength
... Economy
... Versatility



RAM ADAPTER. This forging weighs 58,780 lb, and measures 140 in. x 73 in. x 25 in.



STEEL CYLINDER for use in 7,500-ton plate stretcher. This forging weighs 171,240 lb, and it's 17 ft, 3 in. long.

GENERATOR SHAFT. Weight, 198,240 lb. As you can tell from these photos, Bethlehem is well-equipped for machining.

REACTOR VESSEL CLOSURE. The OD of this 50,660-lb forging measures 12 ft.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

PRECISION TOOLS — a few of the many Starrett micrometer types and sizes.

how will you have your Starrett® precision?

Starrett, the name that stands supreme for precision and reliability in micrometers, also stands for the widest possible choice of types and sizes. It takes 357 catalog numbers to list the complete line — from ½" capacity to micrometers of six foot range and more — all with exclusive precision features including no-glare SATIN-CHROME finish pioneered by Starrett for better, faster, easier reading.

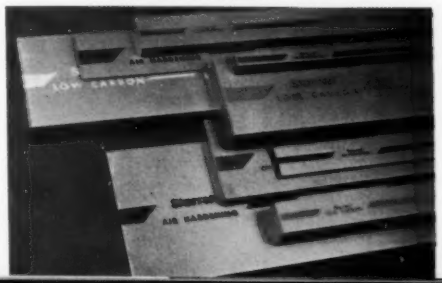
Your nearby Industrial Supply Distributor stocks Starrett micrometers and a complete line of other Starrett products made to the same high standards of quality. Call him or write for complete catalog No. 27. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

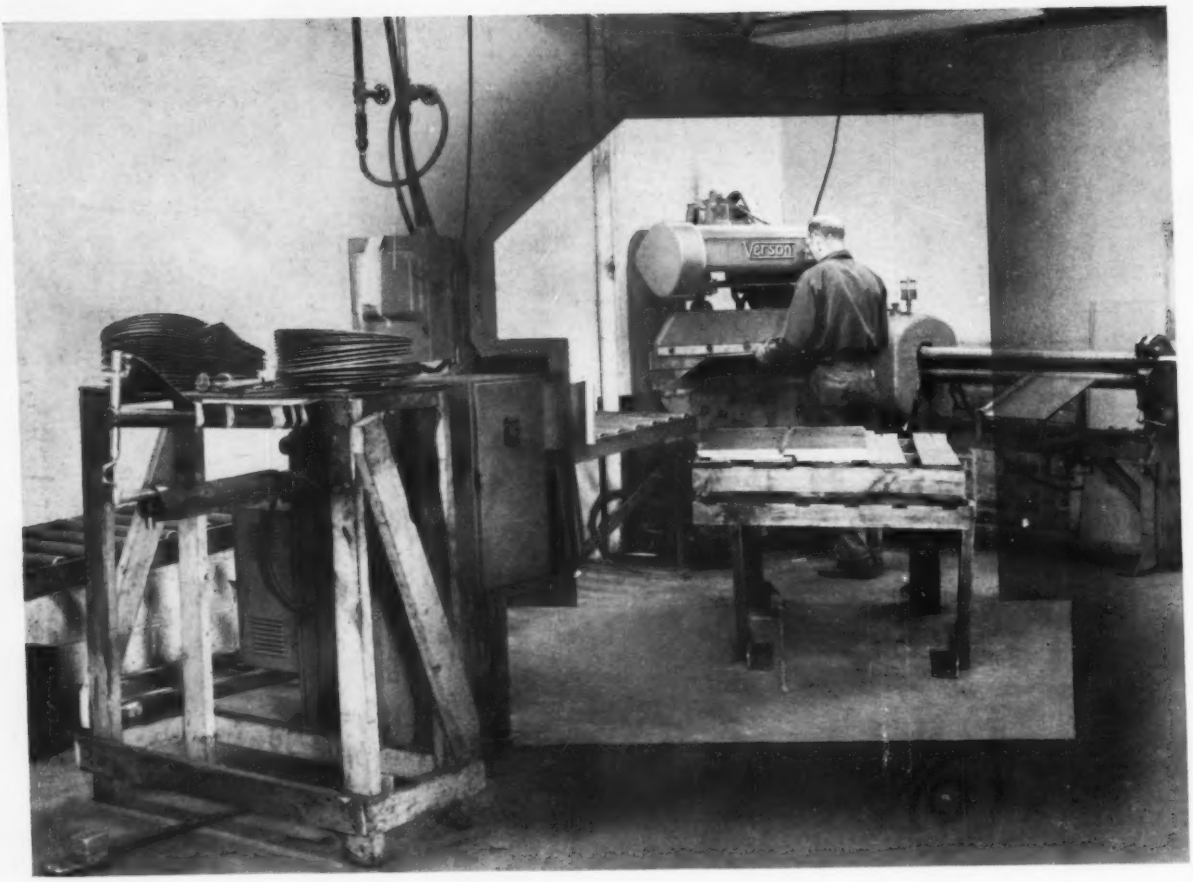
World's Greatest Toolmakers

DIAL INDICATORS AND GAGES

HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

PRECISION GROUND DIE AND FLAT STOCK





1 Man "Production Line" fabricates Blower Housings with -Verson- Press Brake at the C. A. Olsen Manufacturing Company

To economically produce blower type housings used in their Luxaire furnaces, the C. A. Olsen Company, Elyria, Ohio, has set-up a one man production line utilizing a Verson 16-48 Press Brake.

Pre-blanked stock is first fed into the brake making a bend on each of the long sides. The operator then runs the part through the roll former, to his right, forming the sheet into a circular shape. This completed, he returns to the press brake where one of the short ends is formed. The semi-completed part is then placed on the conveyor, to his left. After 30 such parts are formed, the operator moves to the spot welder at the left, and spot welds the pre-blanked side, completing the housing.

If you have a productive requirement involving press or press brake forming, ask to have a Verson sales engineer go over your needs with you. He will be pleased to show you how to make the most efficient use of Verson equipment.

VERSON STANDARD BRAKES AVAILABLE FROM STOCK

Big in performance, small in cost, the Verson 16-48 and its larger companion, the 1062 are rugged efficient power press brakes designed to do a man sized job at minimum cost. They are built to bring the advantages of big brake performance to the smaller shop or to handle smaller jobs in the larger shop.

To provide the highest quality at the lowest cost, both models are made as standard production items, and are shipped promptly from stock. Write for details.

Originators and pioneers of allsteel stamping press construction

VERSON ALLSTEEL PRESS CO.

Verson

9309 S. Kenwood Avenue, Chicago 19, Illinois • 8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES

TRANSMAT PRESSES • IMPACT MACHINING PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES • HYDRAULIC SHEARS

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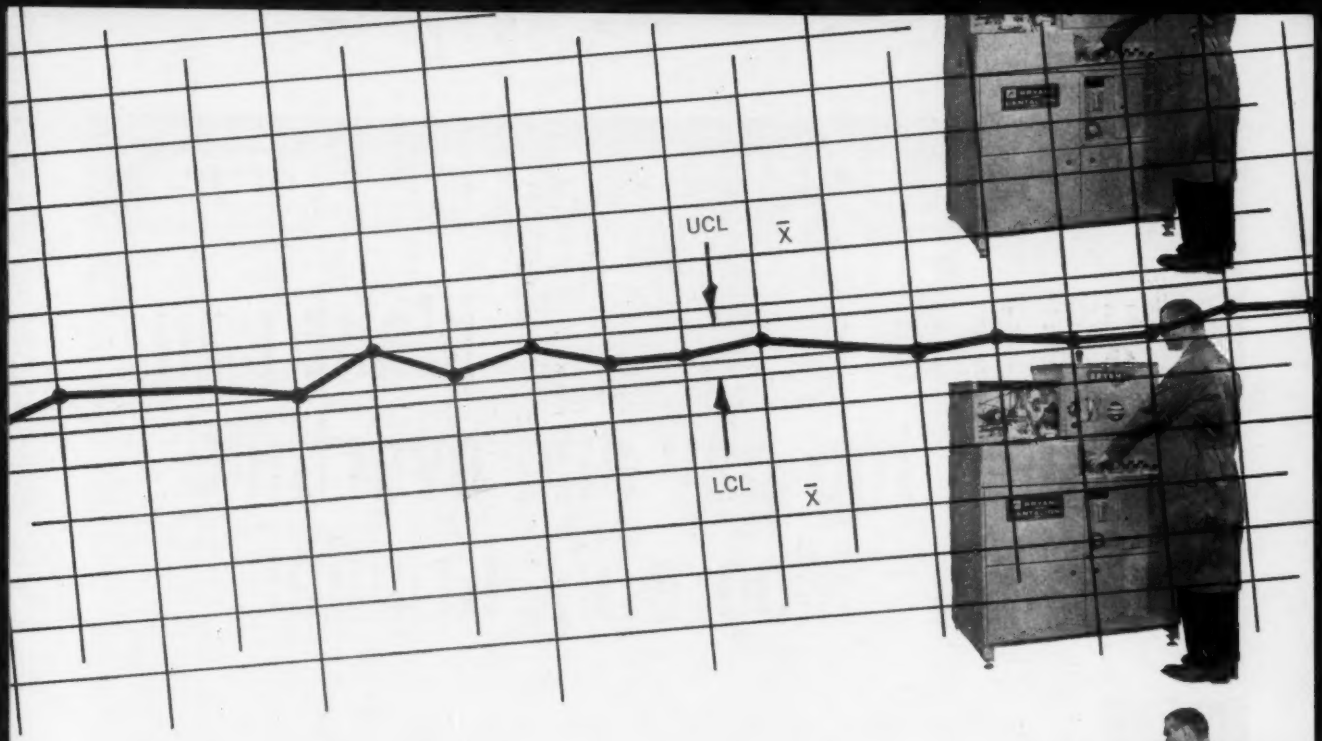


TEST CURVES LIKE THIS

PROVE OUT

BRYANT GRINDERS

The test curve above is typical. It shows the average size variation of the I.D. in a run of sample parts ground to customer specifications on a Bryant Internal Grinder. From this curve and other data, Bryant engineers evaluate the machine's *long term* precision capabilities, using mathematical laws of probability. Result: a job-engineered machine, tested under actual production conditions — *proved out* by statistical quality control methods. Logical reasons why a Bryant Production Internal Grinder is best suited to maintain the required quality standards in *your* plant. Contact your nearest Bryant or Ex-Cell-O sales representative for full details.

This Model "B" Centalign® provides quick changeover and high precision on short or long production runs of small workparts.

BRYANT

Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.

Internal Grinders • Special Machinery

Recent help-wanted advertisement appearing in Minneapolis Morning Tribune.

Must be experienced. Call Mr. York or Mr. Rose at TU 8-5922.
TOOL ROOM
JIG GRINDER
ON NEW MOORE JIG GRINDER
NITES—TOP PAY & OVERTIME
American Mach. & Tool Co.
205 NORTH 3RD ST.
FE 9-7241
TOOL & MOLD MAKERS

Why this plant can afford top pay and overtime on its Moore Jig Grinder

This versatile precision machine has been a *night-and-day* moneymaker throughout the twenty-odd years since Moore pioneered the principle of Jig Grinding. Ask any Moore owner! Ask Carl A. Berg, for example, who ran the above advertisement for his new No. 3 Moore Jig Grinder in a Minneapolis newspaper recently.

That's because Jig Grinding is the happy answer to the ever-present problem of accurately locating and grinding holes, contours and surfaces to size in hardened steel and carbides. The No. 3 now holds tolerances to *less than a tenth!* See positioning accuracies under photo of the machine at right.

Mating parts such as punches and dies can be finished concurrently and made to figures by Jig Grinding with the Moore, rather than just "to fit." Service life is greatly increased, because fits are more accurate, alignment is assured and surface finish is improved.

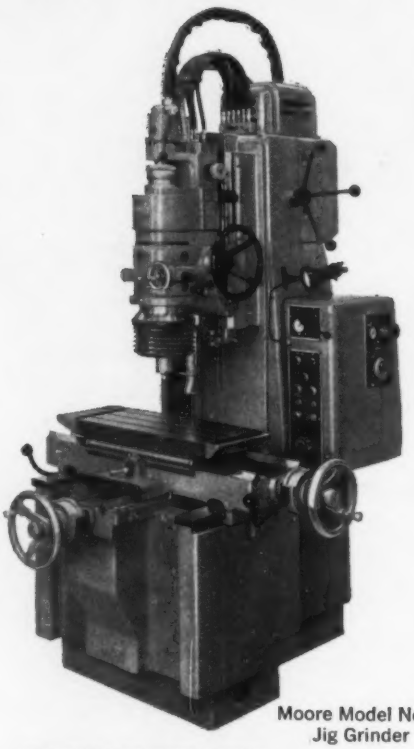
The flexibility and accuracy that make it a "must" for toolroom applications also make the No. 3 Jig Grinder a key machine in model, experimental, precision machining, and development work. Here, prototype and critical parts are quickly produced to the closest tolerances required.

When users offer top pay and overtime to operators of this busy machine, *they do so because it earns that kind of return* ...for toolroom, production, experimental laboratory and inspection assignments.

May we prove it to you?

MOORE SPECIAL TOOL COMPANY, INC.
734 Union Avenue, Bridgeport 7, Conn.

HOLES, CONTOURS AND SURFACES, Moore's authoritative book of 424 pages, 495 illustrations on tool, die and precision parts production, includes these fine chapters: "Jig Grinding Principles and Applications," "Jig Grinding Holes," and "Jig Grinding Contours." $5 in U.S.A., $6 elsewhere.



Moore Model No. 3 Jig Grinder

ACCURACY OF POSITIONING

LONGITUDINAL TRAVEL:
Greatest error in any inch ..... 30 millionths
Greatest error in 18 inches ..... 90 millionths

CROSS TRAVEL:
Greatest error in any inch ..... 30 millionths
Greatest error in 11 inches ..... 90 millionths

SQUARENESS:
Compound slide ..... 60 millionths
Travel, spindle housing ..... 90 millionths in 13″
Travel, spindle ..... 90 millionths in 3⅝″

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

SEALED! SHIELDED! PROTECTED!

hoover quality BEARINGS AT THEIR BEST

Hoover bearings achieve highest quality standards through the use of exclusive *Micro-Velvet* balls, accurate within millionths of an inch, and *Hoover-Honed* raceways that are super smooth, superbly finished.

To preserve this superior quality throughout extended life, Hoover bearings can be protected with shields and seals to lock out dirt, grime and other harmful contaminants. As shown above, shields, seals in Teflon and felt, and a combination of shields and seals meet a wide range of requirements. To assure highest quality . . . best protection . . . specify Hoover sealed or shielded ball bearings. Get complete information from your local Hoover bearing distributor listed in the Yellow Page Directory, or write us direct.

Micro-Velvet and *Hoover-Honed* are Hoover Trademarks. Teflon is a DuPont trademark for its fluorocarbon resins.

hoover

BALL AND BEARING COMPANY

5400 South State Road, Ann Arbor, Michigan

Zone Sales Offices and Warehouses | 8581 South Chicago Ave., Chicago 17, Illinois
290 Lodi Street, Hackensack, New Jersey
2020 South Figueroa, Los Angeles 7, California

Hoover Ball and Bearing Company
5400 South State Road, Ann Arbor, Michigan M-3

Please send me information on Hoover sealed and shielded ball bearings.

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Title_____

Company_____

Address_____

City_____ Zone_____ State_____

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New

RED RING MACHINE SHAVES LARGE GEARS FASTER... MORE EFFECTIVELY

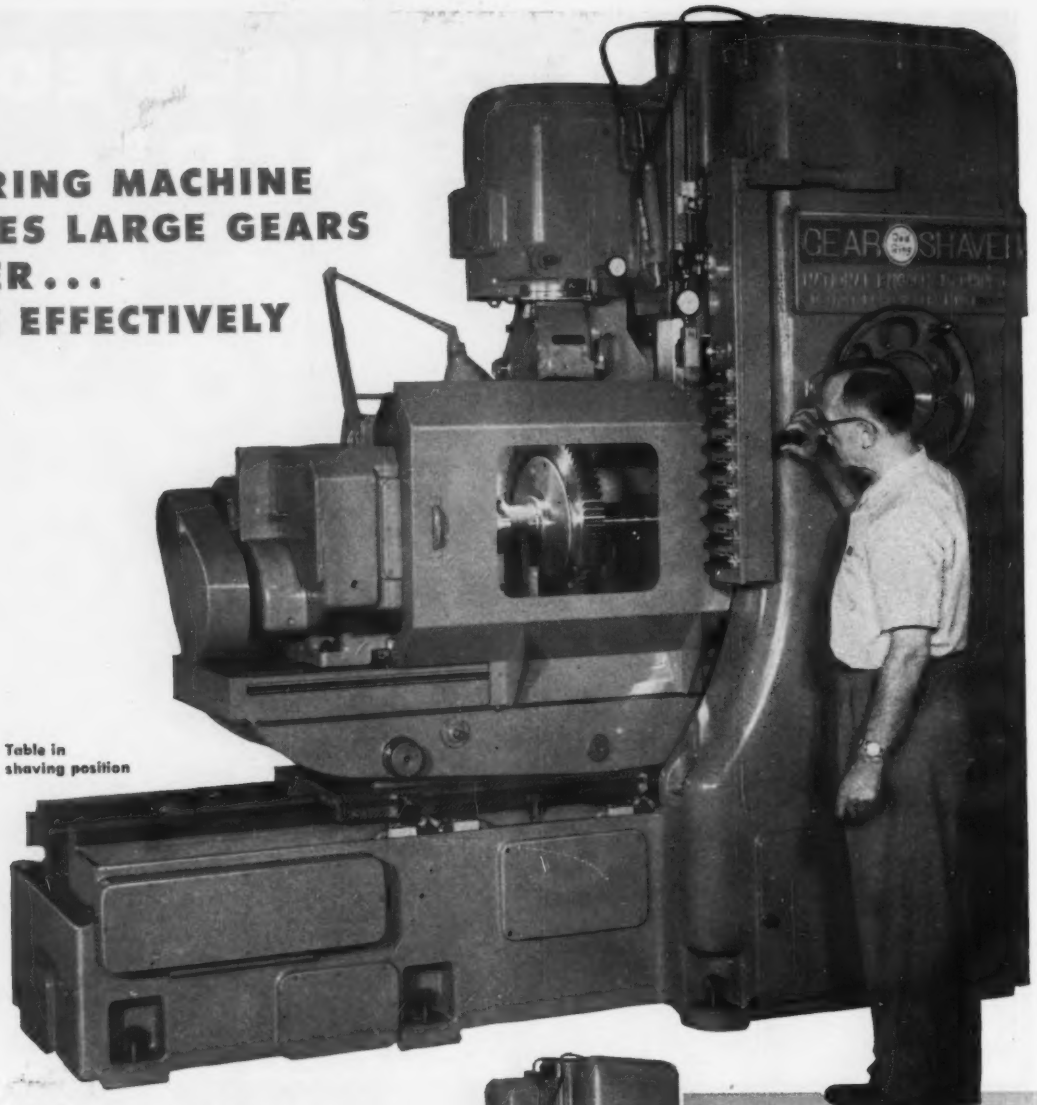


Table in shaving position

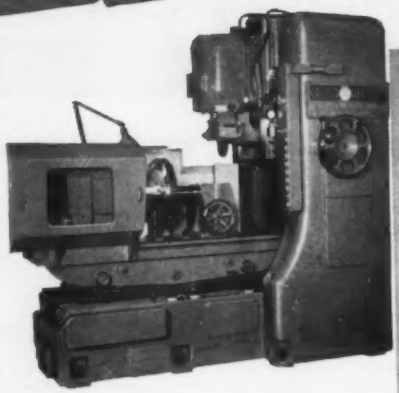


Table in loading position

Significant design innovations in the New Model GCX enable you to shave the larger, heavier gears (up to 24" Pitch dia.) with the same facility and precision as smaller gears are shaved.

Methods of loading and unloading are unrestricted. The work is loaded with the table at the extreme limit of its travel—clear of any overhead interference.

At the end of the shaving cycle, the cutter head rises in rapid traverse to clear the work and the table returns to its loading station for quick unloading.

If you manufacture such gears as are used in trucks, agricultural or ordnance equipment, ask for Bulletin S60-8 and get the full details of this new, economical method of gear shaving.

EXCLUSIVE RED RING ADVANTAGES

- Cutter above the work permits chips to fall away from and not into the cutter teeth.
- Thus positioned, the cutter is not vulnerable when the work is accidentally dropped while being loaded.
- Cutting pressure is applied downward, taking full advantage of gravity for rigid stability.
- Floor space, less — Rigidity, greater

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING AND HONING EQUIPMENT

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By Fred E. Graves

Fastening of "blind hole" joints

Holes which don't go all the way through a solid member must be tapped, of course. In shallow, small holes, in non-critical fastening, and in soft materials thread cutting screws work well and save time.

But fastening large flanges, pressure plates, heads and the like to costly castings needs more precise production. These holes are ¼" diameter and larger, affect design strength.

THREAD EFFECTS

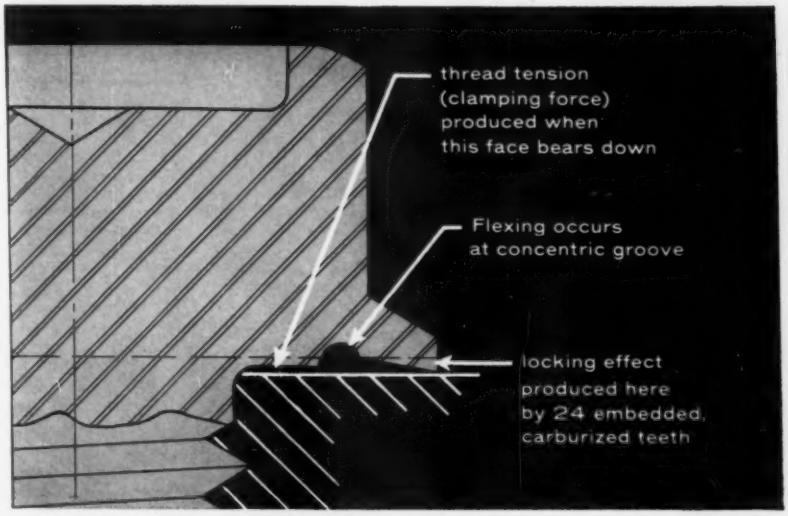
Such holes are coarse threaded. The coarse threads develop more thread strength than do fine threads, also take fewer turns in assembly. Studs go into the holes with an interference thread fit; hex screws with a simpler clearance fit.

Desirably, studs should all be driven to same depth and bottomed. Because of normal manufacturing differences, various mismatched high and low tolerances will cause studs to project unevenly. Assemblers often have to juggle. No such problem exists with hex screws. You just tighten to specified preload. And there's no double driving operation, as with stud plus nut.

STRENGTH OF BLIND JOINTS

Tapped holes behave like nuts. Their threads adjust elastically and plastically to distribute stress and develop high thread tension. Is this harmful in repeated disassemblies? Not at all. Hex screws have been installed 50 times in cast iron test blocks, then tightened to failure without damage to tapped holes.

Clamps like a hex screw Grips like an anchor



Tensilock® screws offer you the ideal combination of high clamping force and high locking power.

While a standard high strength hex screw can be tightened to a higher thread tension, its off-torque is less than its on-torque.

ANCHORED IN PLACE

The *"Tensilock"* screw features ratchet action teeth formed at an angle which will cut driving effort to permit you to utilize more of the full strength of screw. At equal driving torque, it not only develops 90% of the strength of a high strength hex screw but also takes *25% more torque to loosen than to tighten.*

Because of the flange's concentric groove, it flexes, allows the screw to bear down solidly on its seat and develop a high level of thread tension. At the same time the teeth embed themselves, are aided in maintaining their grip by pressure of the spring-action flange.

MAKES GOOD FRICTION-TYPE JOINT

Clamping force from Tensilock fasteners is sufficient to prevent slippage of fastened members where holes are oversize or eccentric. Grip of the teeth keeps fasteners tight under conditions of vibration or cyclic temperature changes. RB&W *"Tensilock"* Nuts also available. Write for Bulletin TL-2. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

® Registered and Patented

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa., Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

For more data circle this page number on card at back of book

VALUE ANALYSIS FACT SHEET

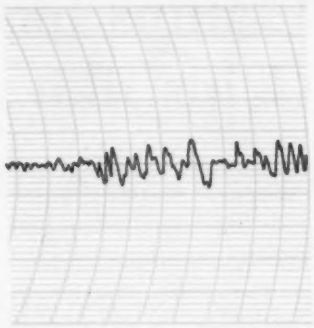
Formbrite Drawn Brass Parts

How to open finishing room bottlenecks and cut polishing costs up to 50%—produce stronger, more scratch-resistant parts—and get additional savings —with Formbrite, superfine-grain drawing brass.

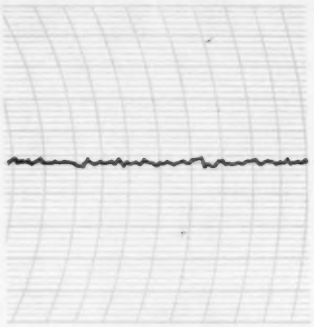
Very often in the production of drawn brass parts which are to be plated or lacquered, finishing costs are greater than those of all preceding operations —or even the cost of the metal. Under any circumstances, they are a high percentage of total costs.

Furthermore, parts go through the pressroom a lot faster than they can through the finishing room, creating bottlenecks in production.

ENLARGED SURFACE TRACES at the right prove that you can lick both cost and time problems with Formbrite®, Anaconda superfine-grain drawing brass. Savings in polishing costs reported by users run from 40 to 50%. These are net savings, as Formbrite costs no more than ordinary drawing brass.

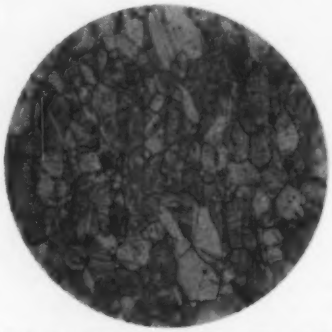


Enlarged surface trace of standard drawing brass (grain size, .045 mm) after 40% elongation. This kind of roughness causes "orange peel" effect in the working of standard drawing brass. Smoothing such mountains down to the valleys takes considerable cutting.



Enlarged surface trace of Formbrite drawing brass (grain size, .005 mm) after 40% elongation. Surface smoothness after deformation is the test of a drawing brass's polishing characteristics. It is relatively easy to level these little hills on the surface of Formbrite. In many cases, users find they eliminate cutting operations altogether, need only a simple color buff.

STRONGER, MORE SCRATCH RESISTANT. Formbrite is stronger, harder, springier than the usual drawing brasses in the same standard tempers, yet retains remarkable ductility for forming and drawing, and takes sharp, clean-cut ornamental die impressions. The harder surface means fewer rejects from scratching and marring during handling. In some instances, the superior strength and hardness of Formbrite make possible the use of a thinner gage metal, with an additional saving in material cost.



This is the microstructure, shown 75x, of the standard drawing brass used above.

This uniform superfine-grain structure of Formbrite, shown 75x, is produced by special procedures for rolling or drawing and annealing developed by Anaconda American Brass Company.

SIZES AND TEMPERS. Brass manufactured by the Formbrite method, with its special characteristic of superfine-grain structure, is supplied in standard Formbrite temper, half-hard, three-quarter-hard, hard, and extra-hard tempers, and can be rolled in heavy coils to .004" in thickness by 24" wide, weighing 100 pounds per inch of width. The table below gives physical data and terminology for Formbrite tempers.

ALLOYS. In addition to 70-30 brass, the following Anaconda alloys also are produced by the Formbrite method: Yellow Brass-59, Gilding Brass-4, Commercial Bronze-14, Red Brass-24, and Low Brass-32.

TECHNICAL ASSISTANCE. For help in selecting the alloy and temper to handle your particular job—for a copy of Publication B-39 with more details about Formbrite—see your Anaconda representative. Or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6145

TERMINOLOGY FOR FORMBRITE TEMPERS

TENSILE STRENGTH LB. SQ. IN.		ROCKWELL B HARDNESS		DESIGNATION TO BE USED
MIN.	MAX.	MIN.	MAX.	
49,000	59,000	40	65	Yellow Brass—Formbrite
57,000	67,000	60	77	Half-hard Yellow Brass—Formbrite
64,000	74,000	72	82	Three-quarter-hard Yellow Brass—Formbrite
71,000	81,000	79	86	Hard Yellow Brass—Formbrite
83,000	92,000	85	91	Extra-hard Yellow Brass—Formbrite

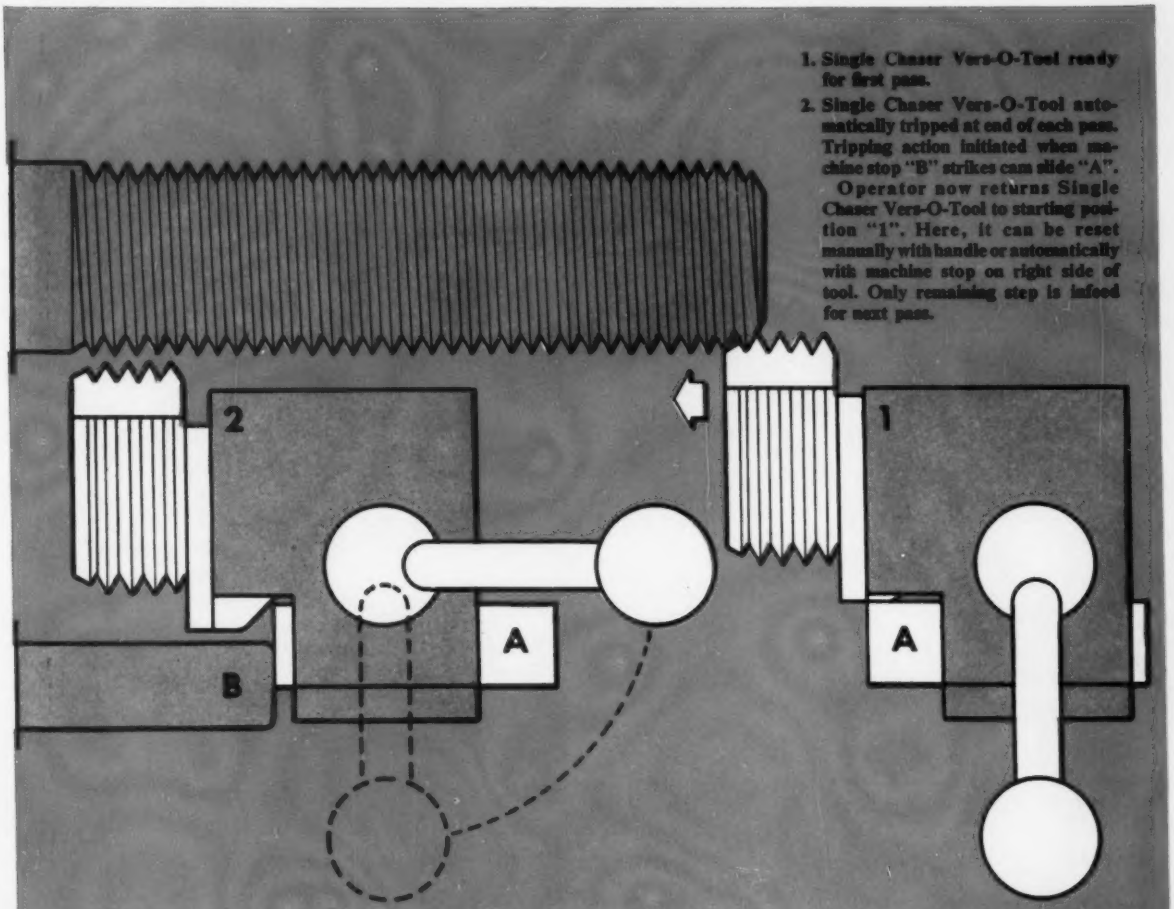
FORMBRITE

Superfine-grain drawing brass

a product of

ANACONDA®

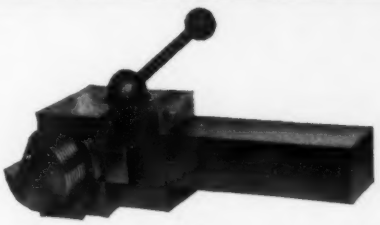
Anaconda American Brass Company


1. Single Chaser Vers-O-Tool ready for first pass.
2. Single Chaser Vers-O-Tool automatically tripped at end of each pass. Tripping action initiated when machine stop "B" strikes cam slide "A". Operator now returns Single Chaser Vers-O-Tool to starting position "1". Here, it can be reset manually with handle or automatically with machine stop on right side of tool. Only remaining step is infeed for next pass.
2
1
A
A
B

Only NAMCO's Single Chaser Vers-O-Tool

Trips Automatically... Boosts Short Run Threading Efficiency

Unlike other single point threading tools, NAMCO's Single Chaser Vers-O-Tool backs off automatically at the end of the cutting stroke. For short runs, this means more threading in less time. And, because it just isn't possible to attempt the return stroke while the tool is still at cutting depth, scrappage is eliminated. The tool's multiple cutting edges mean greater threading accuracy and longer tool life while NAMCO's exclusive resharpening method permits quick tool change and precise reset. In short, *nothing* beats NAMCO's Single Chaser Vers-O-Tool for short run threading efficiency. Get complete details on this and all the rest of NAMCO's complete line of Vers-O-Tools. Write today for our 44 page Bulletin DT-60.



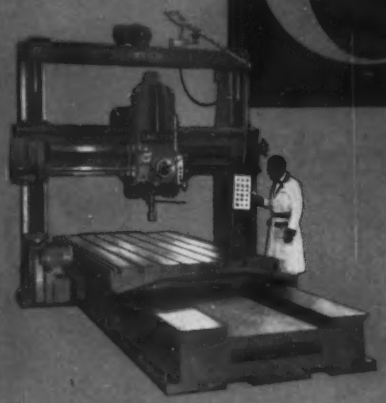
National Acme

THE NATIONAL ACME COMPANY
179 E. 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

For more data circle this page number on card at back of book

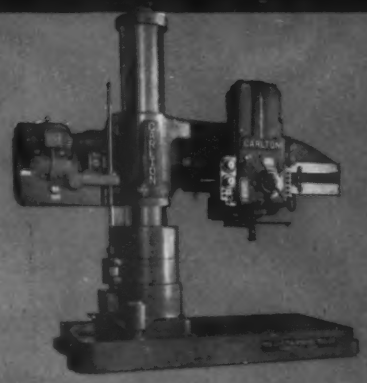
Carlton



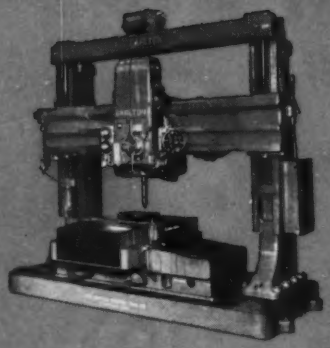
NEW PLANER TYPE BORING AND DRILLING MACHINE with numerically controlled automatic positioning. Accurately locates work for boring, reaming, drilling, tapping.

HORIZONTAL DRILLS now with numerical control . . . for tape, keyboard or pushbutton control. Allows any shop to automate boring, drilling, reaming, tapping.

for all your heavy duty boring and drilling requirements



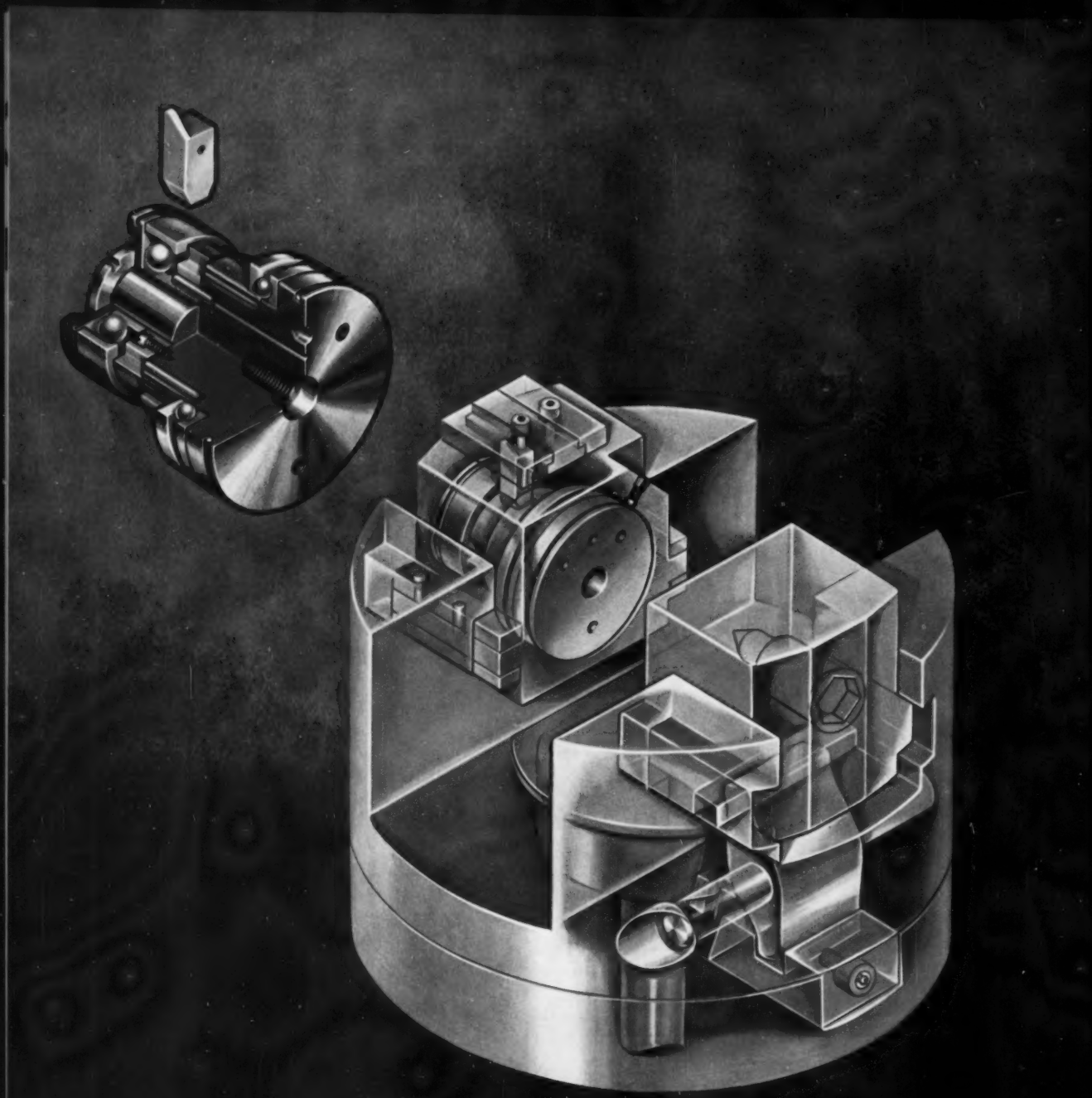
RADIAL DRILLS. The best known, most highly respected and widely used radial drills. Made in column diameters from 9″ to 26″, arm lengths from 3-ft. to 12-ft.



NEW VERTICAL DRILLING MACHINE with automatic positioning (or spacing) table. Introduces jigless heavy duty boring and drilling, puts it on a production basis for the first time.

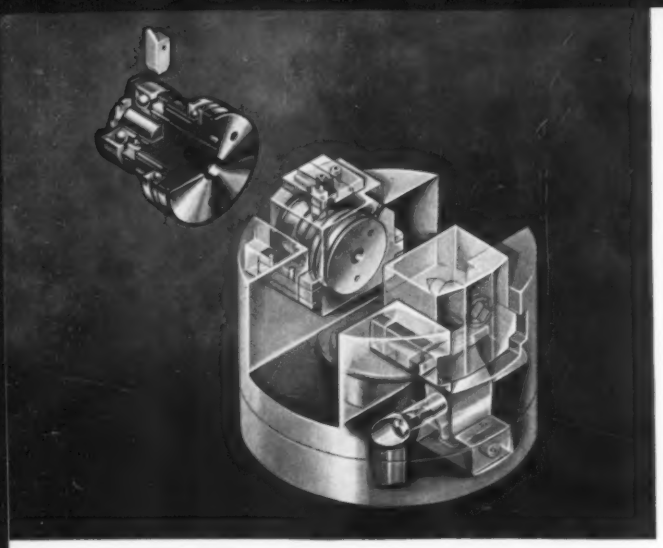
NOW: NUMERICAL CONTROL by Carlton Controls Corp. for Carlton 4H and 5H horizontal drills and for Model ARS planer type boring and drilling machine. Write for complete information.

THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO / *Specialists in boring and drilling machines since 1916*



Here is another major chuck development from

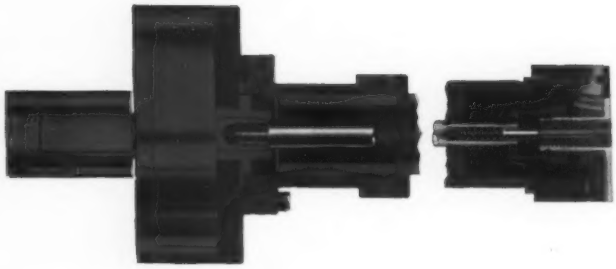
SKINNER



A heavy-duty power chuck with jaws that freely index under full pressure. Indexing is simple, easy, and fast. The operator can index manually without touching the work or releasing the pressure. Jaws are indexed by means of a lock screw and slide plate. Note the size and shape of the indexing pin. It fits firmly and positively into the indexing plate so that extreme accuracy of indexing is assured.

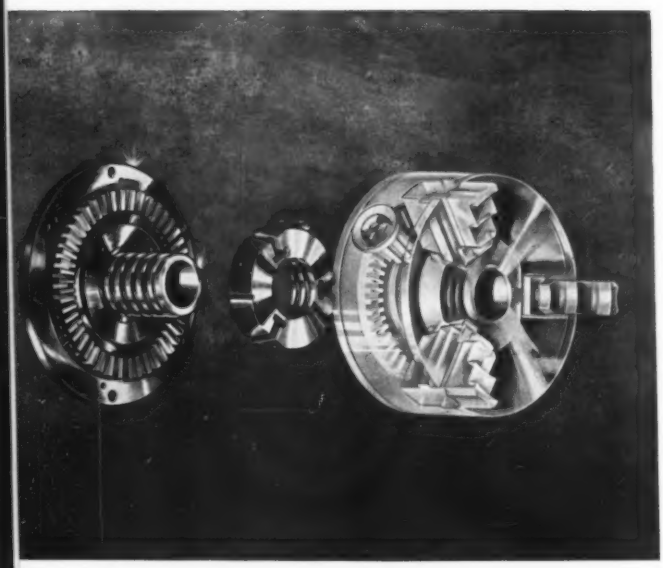
One or both jaws can be furnished with indexing mechanisms. As a result, you can index more positions and smaller index angles. There is no need to buy a new chuck for different indexing positions because index jaws or index components can be interchanged quickly and easily.

This new Skinner chuck is available in all body diameters from 12″ through 36″.



The only power chucking unit for Brown & Sharpe and similar automatic and hand screw machines. The addition of this unit to your screw machine permits power chucking of cold drawn parts, small or odd shapes and castings.

The Skinner unit, recommended by Brown & Sharpe, consists of a 4-inch air chuck with two or three jaws and work ejector, a threaded draw bar, a rotating air cylinder and a cylinder adapter. Hand, foot, or solenoid valves and power chucking accessories are also available. Average installation time—ninety minutes.



The first major chuck development in fifty years! This extra-heavy-duty Wedge-Screw chuck develops tremendous gripping power, high accuracy and repeatability by a unique principle. When the lug-type pinion is turned manually or by a power wrench, it engages the gear plate causing the screw to move the wedge. The force of the wedge on the jaws holds the work with tremendous power.

This Wedge-Screw chuck has such useful features as:

Accuracy—within .001 total indicator reading

Repeatability—within .0005 total indicator reading

Complete Range—no size limitation

Many other features including over-tightening and operator protection, sealed operating mechanism, automatic lubrication, etc.

For more information about these major chuck developments, contact your Skinner representative or write directly to us.

SKINNER CHUCKS®

THE CREST OF QUALITY

SKINNERCHUCKS

SKINNER-HORTON CHUCK DIVISION

SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

BAUSH

8-Way Unit Machine with Rotary Table

Completely **machines exhaust manifolds from rough casting to finished job at rate of 100 per hour**

Exceptionally rugged to stand up under continuous 3-shift operation with a minimum of down-time, this NEW BAUSH SPECIAL 8-WAY UNIT MACHINE consists of:

- 2 Vertical hydraulic units mounted on cross slide
- 1 Vertical angular hydraulic unit mounted on sub-base
- 1 Vertical hydraulic unit mounted on horizontal slide
- 3 Vertical angular mechanical leadscrew units
- 1 Vertical angular hydraulic unit

Units are equipped with 3 milling heads, 2 spherical cutting heads, 2 drilling heads and 1 individual leadscrew tapping head. Hydraulic "V" jaws clamp part into 8 holding fixtures mounted on an 80" diameter rotary table having paddles that automatically dispose of chips to outside of machine.

Total weight 110,000 lbs.

Closeup of fixtures showing manifold in position for machining.

BAUSH

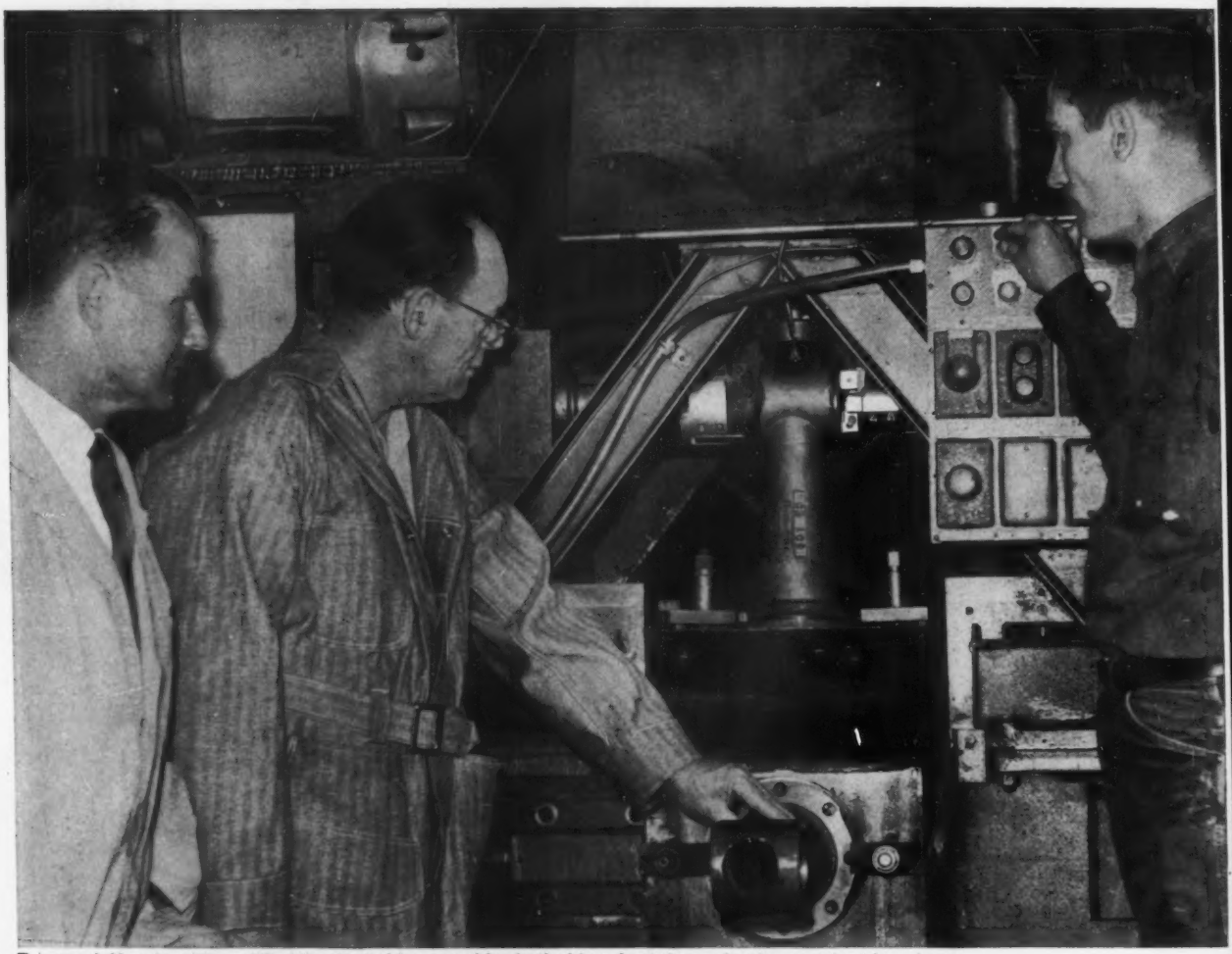
Send us your problems and prints — let us design and build your next single purpose multi-spindle machine tool. We have the experience and "know-how," backed by over 60 years of making machines that will "stand-up" to any job.

BAUSH machine tool co.

SPRINGFIELD 7, MASS.

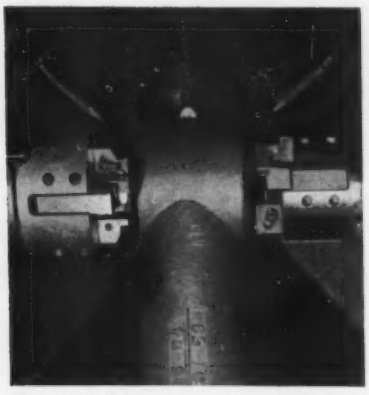
For more data circle this page number on card at back of book

KENDEX* *tailored* TOOLING



Two special heads, with modified Kendex holders, machine both sides of a stub eye simultaneously at American Coleman Company, Littleton, Colorado. Range of bore sizes can be machined by simply resetting tools.

*Trademark



Developed in cooperation with customer's engineers, the two special Kendex boring heads—with Kendex "throwaway" inserts—have increased production, reduced cost per piece and improved the product.

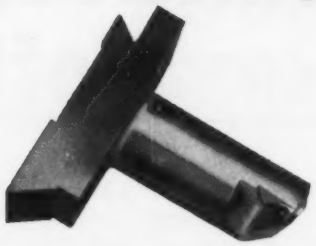
REASONS: Reduced initial set-up time from 3 hours to 30 minutes; eliminated the 5-hour tool regrinding job required after every 80 pieces. Instead of 3-hour set-ups, cutting edges are now indexed within ±.001 inch in 5 minutes. Saved—a full day's machine time for every 100 pieces.

Such IMAGINATIVE attacks on machining costs with Kendex Tailored Tooling are helping fight high costs in many plants. Applications shown at right may suggest operations in your plant where specially-designed Kendex tooling may combine two or more operations in one pass or help reduce machining costs in some other way.

Kennametal Carbide Engineers, trained to analyze tooling applications and backed by our headquarters staff of tooling specialists, are continually helping customers use standard tooling or design special tooling to reduce machine downtime and improve production. To meet the growing demand for Kendex Tailored Tooling, our production facilities have been expanded repeatedly within the last several years.

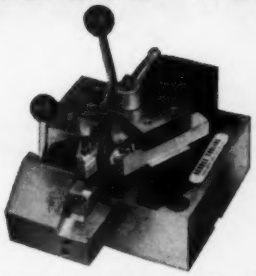
For full details about the Kendex Tailored Tools shown at right, plus many more, call your Kennametal Carbide Engineer. Ask him for our booklet "There's Profit in Retiring a Tradition" which gives dollars-and-cents facts as to how some companies have reduced machining costs as much as 70% with standard Kendex "throwaway" insert tooling . . . or write to KENNAMETAL INC., Latrobe, Pa. 33591

increases production...reduces cost

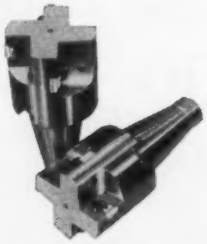


Boring Bar designed for mounting directly on machine tool turret in a gang tooling application. Dovetail mounting permits quick change of bore size.

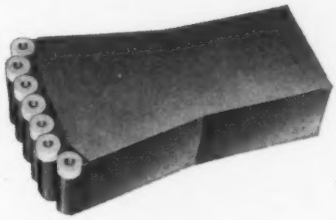
Special K-Bar used for machining transmission cover. Design utilizes threaded construction to allow removal of solid carbide bar from flange.



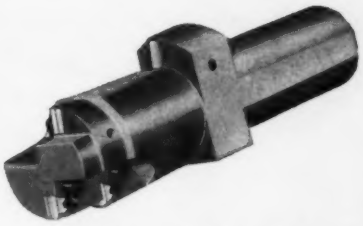
Special Facing, Skiving and Grooving Tool Block (rear slide) for machining transmission gear.



Special Milling Head for milling wrench slots (two flats for spanner wrench) on drill pipe.



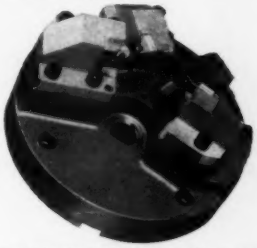
Multi-Screw-On Kendex for machining rough throws on large crankshaft.



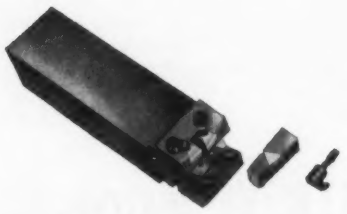
Special Multiple Insert Boring Bar with air coolant holes. Bores three diameters simultaneously.

K-Bar for tracing complex deep hole. High rigidity of Kennametal shank eliminates chatter.

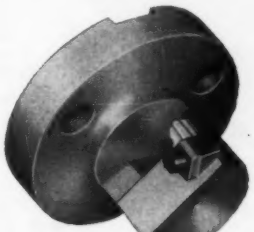
Special K-Bar with adjustable head for machining axle cross bores in differential carrier.



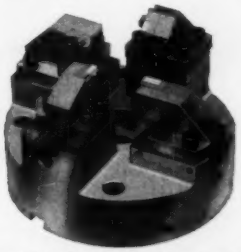
Special Hollow Milling Head for rough turning O.D. of bearing diameters, forming radius and chamfering of diesel tractor roller idlers.



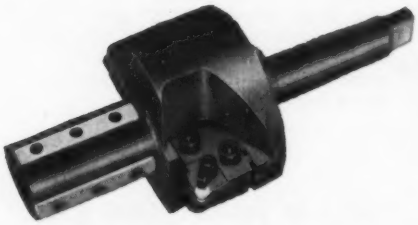
Multiple Insert Kendex Holder for facing and forming O.D. of oil slinger ring on crankshaft.



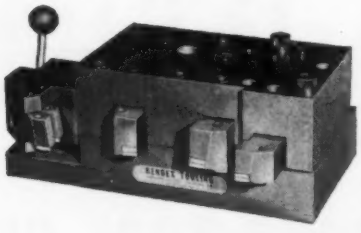
Special Kendex Holder for back facing gear plate of output shaft and planet carrier assembly through hole in gear blank.



Special Hollow Milling Head for finish turning O.D. of bearing diameters, forming radius and chamfering of diesel tractor roller idlers.



Boring Head for rough and finish boring of flywheel housing.



Rear Slide Tool Block for machining (finishing) gear transmission countershaft.

INDUSTRY AND
KENNAMETAL
...Partners in Progress

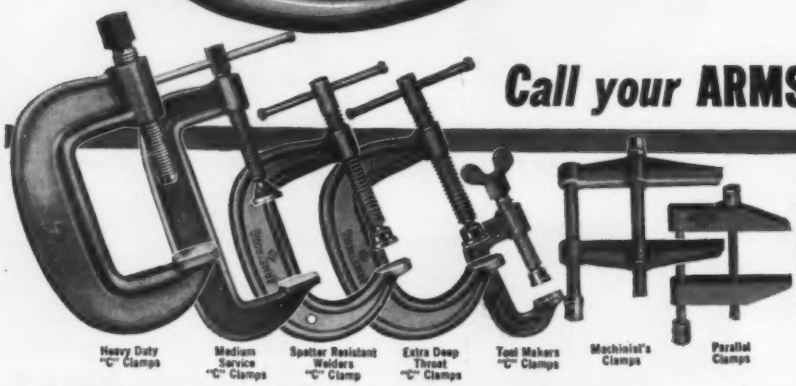
New ARMSTRONG Swivel Pad can't come off

Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 40°.



Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

ARMSTRONG BROS. TOOL CO., 5213 W. ARMSTRONG AVE. CHICAGO 46, ILLINOIS

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Another report on Air-4 tool steel

Blanking and embossing this automotive part, from coiled steel of .125 in. thickness and doing it at substantial speed, is all in a day's work for Bethlehem Air-4 tool steel . . . at Melrath Metal Stamping Corp., Red Hill, Pa. Tool engineers at this plant have several good reasons for giving a good report on Air-4: they like the ease with which it can be machined . . . its simple heat-treatment, and above all, they admire its wear-resistance. Hardened to Rockwell C-60, the die undergoes slight redressing every 100,000 strokes of the press.

HARDENS AT LOW TEMPERATURE

Air-4 is a free-machining, medium-alloy tool steel which hardens in air—at about 1550 F. It has excellent free-machining characteristics because of a lead addition. It also has excellent wear-resistance and high toughness, and is deep-hardening to assure long tool life.

Air-4 is a versatile tool steel. Why not place an order right now for a trial bar, and use it in an experimental run? Your Bethlehem tool steel distributor can give you prompt delivery.

Bethlehem Tool Steel Engineer Says:

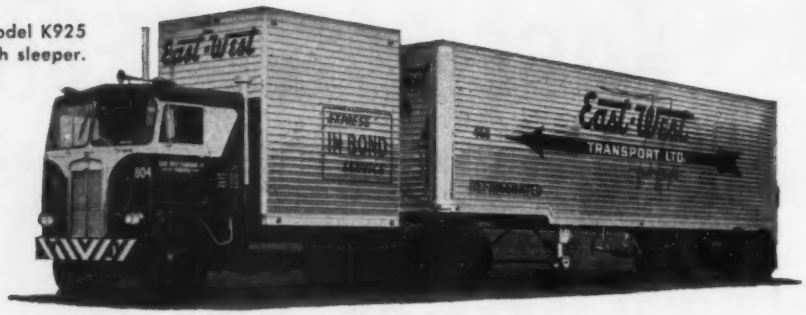
Always Heat-Treat the Tool Instead of the Thermocouple

Many tool failures can be attributed to the use of improper temperatures during heat-treatment. In many instances, although the thermocouple chart may have indicated proper heat-treatment temperatures, the microstructure of the tool shows that the recorded temperatures were not attained by the tool. This is called "heat-treating the thermocouple, instead of the tool."

It is easy to see why such errors occur, for the thermocouple indicates the temperature at the location of its tip only. Most furnaces have some non-uniformity of temperature. For example, locations near the source of heat are hotter than remote locations. And the bottom tends to be colder than the top. An operator who is on the ball will survey his furnaces to determine what temperature differences are present. This will assist him in selecting the location which will provide the most accurate indication of the temperature of tools heated in each furnace. It will often indicate that more than one thermocouple is needed.

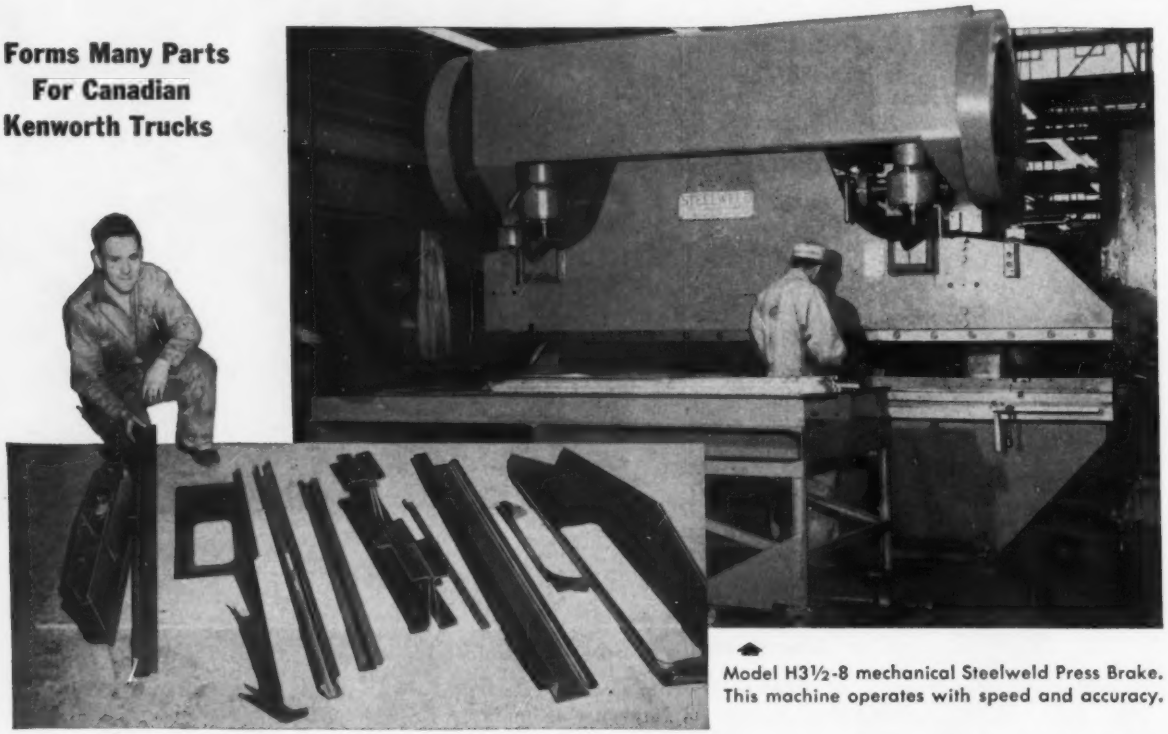
Where a temperature survey is not feasible, the tip of the thermocouple should be placed as near the tools as possible. But avoid locations near the floor, sides, roof, or near the source of heat. Although the thermocouple is accurate, and highly useful, it's by no means foolproof.

Canadian Kenworth model K925
C.O.E. tilt cab with sleeper.



TRUCK PRODUCTION KEEPS STEELWELD PRESS BRAKE BUSY

Forms Many Parts For Canadian Kenworth Trucks



Model H3½-8 mechanical Steelweld Press Brake. This machine operates with speed and accuracy.

A great amount of steel is formed into a variety of shapes on a mechanically-operated Steelweld Press Brake in the modern truck plant of Canadian Kenworth, Ltd., Vancouver, B. C.

Kenworth trucks are custom built to each customer's requirements and are widely used in Canada, the United States, and in many parts of the world where an extra rugged vehicle is required to give satisfactory service.

Since the trucks are made individually, or in small lots, it follows that parts for them are made up in correspondingly small numbers. The Steelweld brake has been found outstanding for this work because of the ease and convenience of the control and gauging devices which permit quick die changes. The bed and ram extension adds to its flexibility of use.

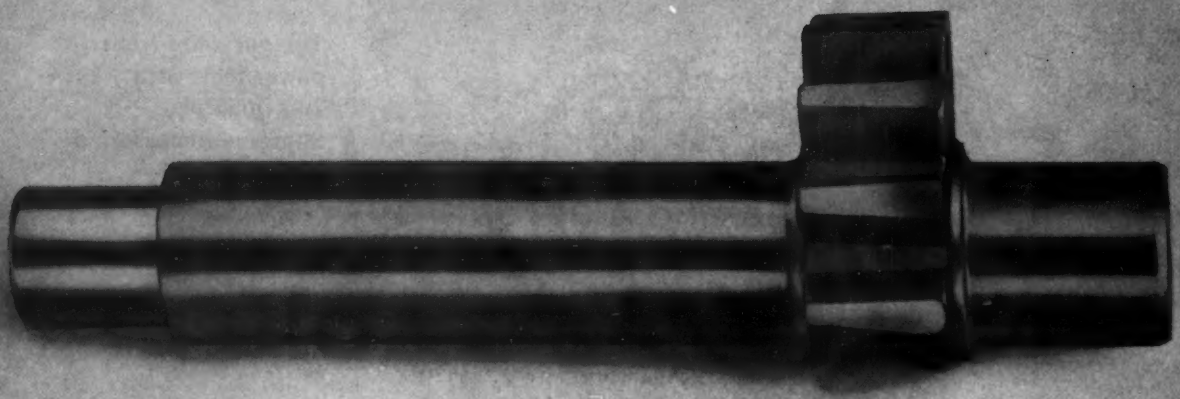
The Steelweld brake, and also a Steelweld shear, have been in continuous satisfactory service since 1955 when the Vancouver plant was put into operation.

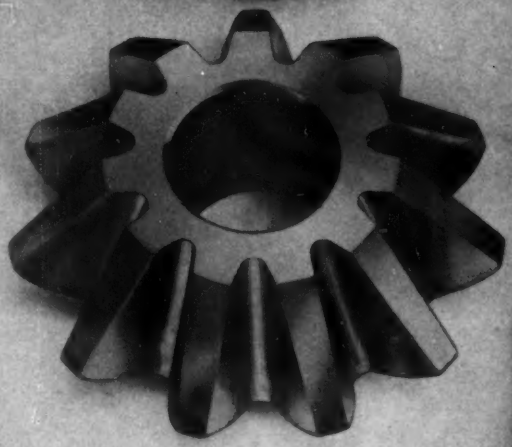
Write for free booklet No. 2023

STEELWELD
Mechanical and Hydraulic
PRESS BRAKES

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5481 E. 282 ST. • WICKLIFFE, OHIO





THE Gleason Revacycle® method and its machine present the fastest way known for cutting precise straight bevel gears.

The Revacycle cutter holds roughing, semifinishing, and finishing blades. One revolution of the cutter completes a tooth space in 2.5 seconds. In fact, on smaller pieces, you can complete as many as four tooth spaces with a single cycle . . . that's less than ½ second per tooth!

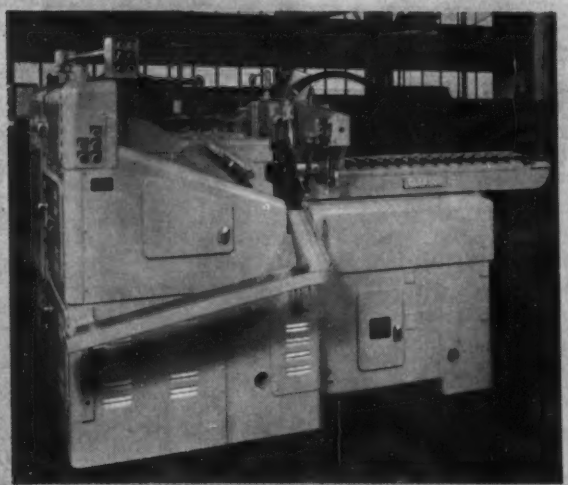
This completely automatic Gleason machine can frequently replace a tandem of roughing and finishing machines . . . thereby saving considerably on capital investment.

Best of all, to get this speed and economy you need sacrifice nothing in accuracy. The Revacycle method produces localized tooth bearing which permits any practical assembly tolerances while avoiding load concentration at the ends of the teeth. And, you get exact reproduction piece after piece, day after day.

The machine accepts a wide range of work: diameters up to 10″ at a 5 to 1 ratio and face widths up to 1.25″.

For complete background and data, write for a bulletin. Gleason engineers will help you with details on any specific applications.

How to cut a bevel gear tooth in 2.5 seconds



1.2 SECONDS is all it takes to dechuck a finished piece and chuck in a new blank with the automatic loading attachment on the 109 Revacycle Machine.

GLEASON WORKS

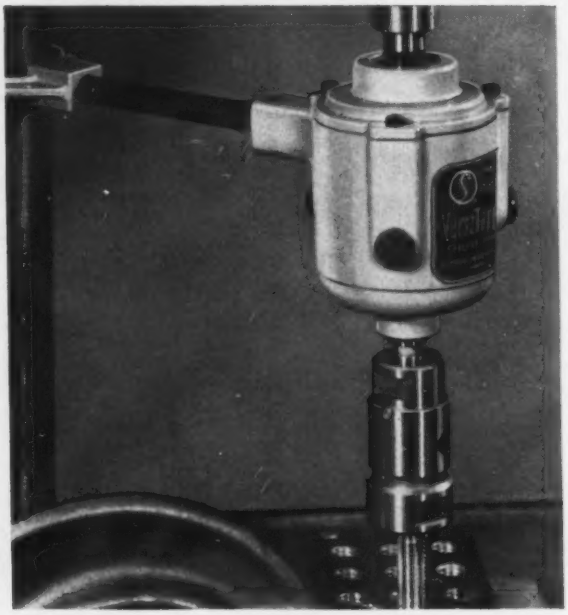
1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

iT'S A FACT!

You can tap 1/2" holes with a light drill press and Supreme's New VersaTAPPER®

Shaft of Model 6100 is held in drill press chuck. No. 6200 (above) has Tapered spindle.

Supreme Accutap Chuck is standard equipment with VersaTAPPER. Capacity 0-½"



VersaTAPPER is a compact precision-made tapping unit. Fits any drill press . . . features 0 to ½" capacity range plus 4-time increase in torque. Easy to install. Simple and quick to remove after use.

VersaTAPPER... operates easily in any material ...with widest capacity range ...yet costs far less

JUST $63 COMPLETE

The *new* VersaTAPPER has scored an instant success with production people everywhere. It has more versatility than other tapping devices. It has the *widest capacity range*—from 0 to ½". It develops *more power*—makes the tapping of ½"-13 holes a simpler matter, even with light duty drill presses. VersaTAPPER is *simple to use*—can be successfully operated by anyone in your shop.

All of these features at the remarkably low price of $63 complete marks VersaTAPPER as a product you must see at the first opportunity. It's available at your local Supreme Chuck distributor. Call him soon. Also check number on the reply card in this magazine for literature.

Supreme
PRODUCTS CORPORATION
2222 S. CALUMET AVENUE • CHICAGO 16, ILLINOIS

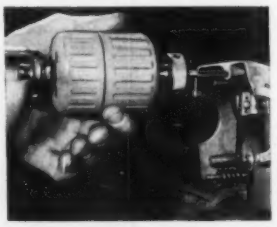
You get more from power tools with Top Quality Supreme Accessories

Supreme Brand Chucks

Noted for unmatched quality. The widest range of sizes and types...one for every machine in your shop. Exclusive Supreme hardening means greater accuracy—longer wear.

Supreme Versamatic

Reversible speed reducer for portable drills. Fits all makes —permits their use for power screw driving, nut running and heavy duty drilling. 7 to 1 reduction means high torque increase. *A fine tool.*



Supreme Push-Pull Tapper

Like the Versamatic, but made for the single purpose of tapping with portable drills. Reverses instantly for tap removal. Handles taps up to 5/16" diameter. Top quality. Simple to operate.

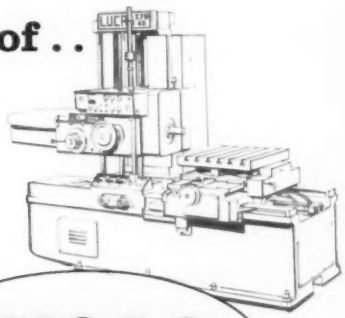
SUPREME PRODUCTS ARE IN STOCK IN YOUR CITY. CALL YOUR DISTRIBUTOR

PRECISION A-S-R PRODUCTS

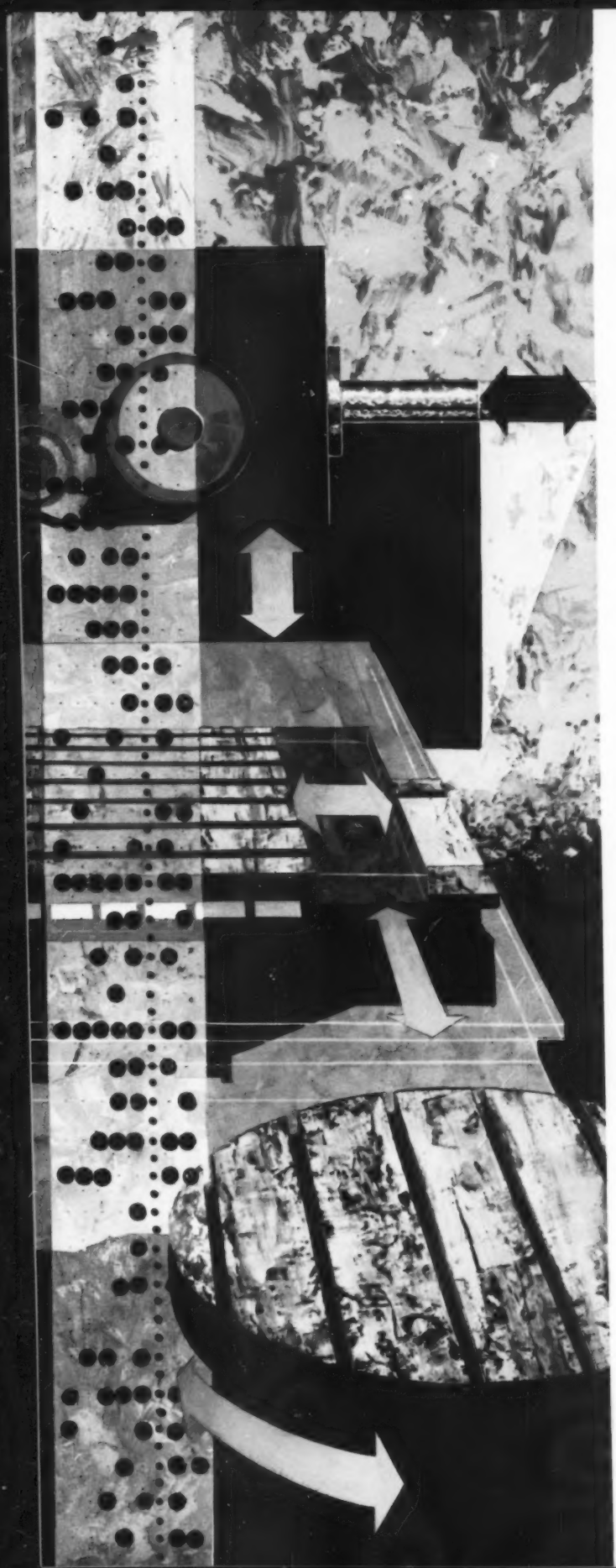
±.0001 accuracy
Versatility unlimited
Small size

The new Model 275-40 presents every famous Lucas feature, *including saddle feed*, compacted into a 2¼" spindle machine specially suited for small, precision work. Any way you look at it, this new Lucas has the size and the machining versatility to fit into your shop or tool room setup. It's a truly profitable machine because it has so much and does so much. You get a built-in rotary table, tape programming if you want it, extreme accuracy for close tolerance machining and on-machine inspection, a new simplified control system, and many other features. Your Lucas representative can give you the whole story and arrange a demonstration right at the Lucas plant if you wish. Contact him or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of precision machining small, intricate pieces . . .

think of . .



LUCAS
PRECISION

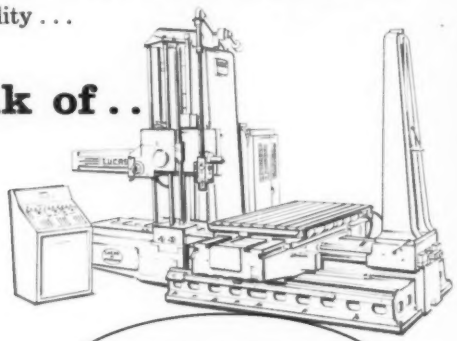


When you think of PROFITABILITY

. . . think of Lucas and tape. They're made for each other. Here's why. The Lucas machine can do more horizontal boring, drilling and milling work better than any other machine on the market. Couple this basic efficiency of a Lucas with the cost savings and reliability of tape control and you have an unbeatable combination for profitable work of the highest precision.

Lucas has applied numerical controls to its full range of boring, drilling and milling machines for a number of years. The various combinations of controls available have all been successfully applied by some of the most knowledgeable metalworking firms in the country. Your Lucas representative can discuss in detail some very interesting case histories and arrange a demonstration for you. Contact him or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of profitability . . .

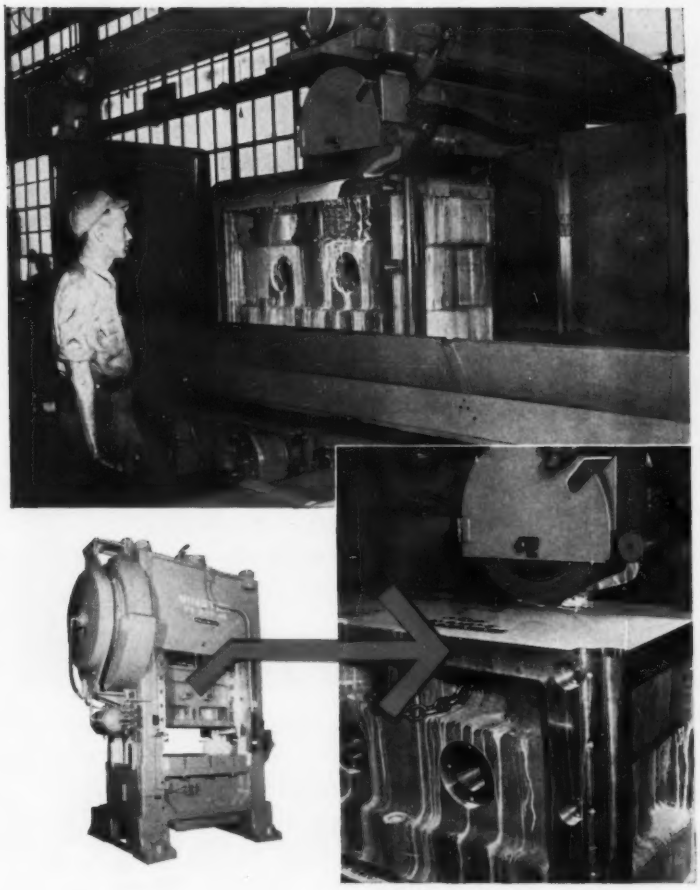
think of . .



LUCAS
PRECISION

SIZE FOR SIZE

there are no heavier or more accurate surface grinders made than these fast, heavy duty Thompsons



Thompson Type CX heavy-duty surface grinders are designed to grind heavy, massive work pieces. Their stock removal rate is very fast while maintaining extremely close limits of accuracy and microfinish.

Shown here is a Thompson Type CX 30x36x96 machine recently installed in the Minster Machine Company plant at Minster, Ohio. It is grinding the face of the slide for a 200-ton capacity Minster Piece-Maker High Speed Automatic Production press.

The slide is cast iron and weighs approximately 7000 pounds. It is being ground for precise parallelism and to a 20 to 30 RMS finish.

Thompson Grinders have an important part in the production of these world-famous Minster presses. The dependability of Thompson Service and the excellent performance of the Thompson machines now in use at Minster were major factors in the purchase of this latest grinder.

If your production involves the grinding of large, heavy work, it will pay you well to investigate the money and timesaving features of these modern machines.

THE THOMPSON GRINDER CO. Springfield, Ohio

Thompson SURFACE GRINDERS

"Keep Thompson in mind for that daily grind"

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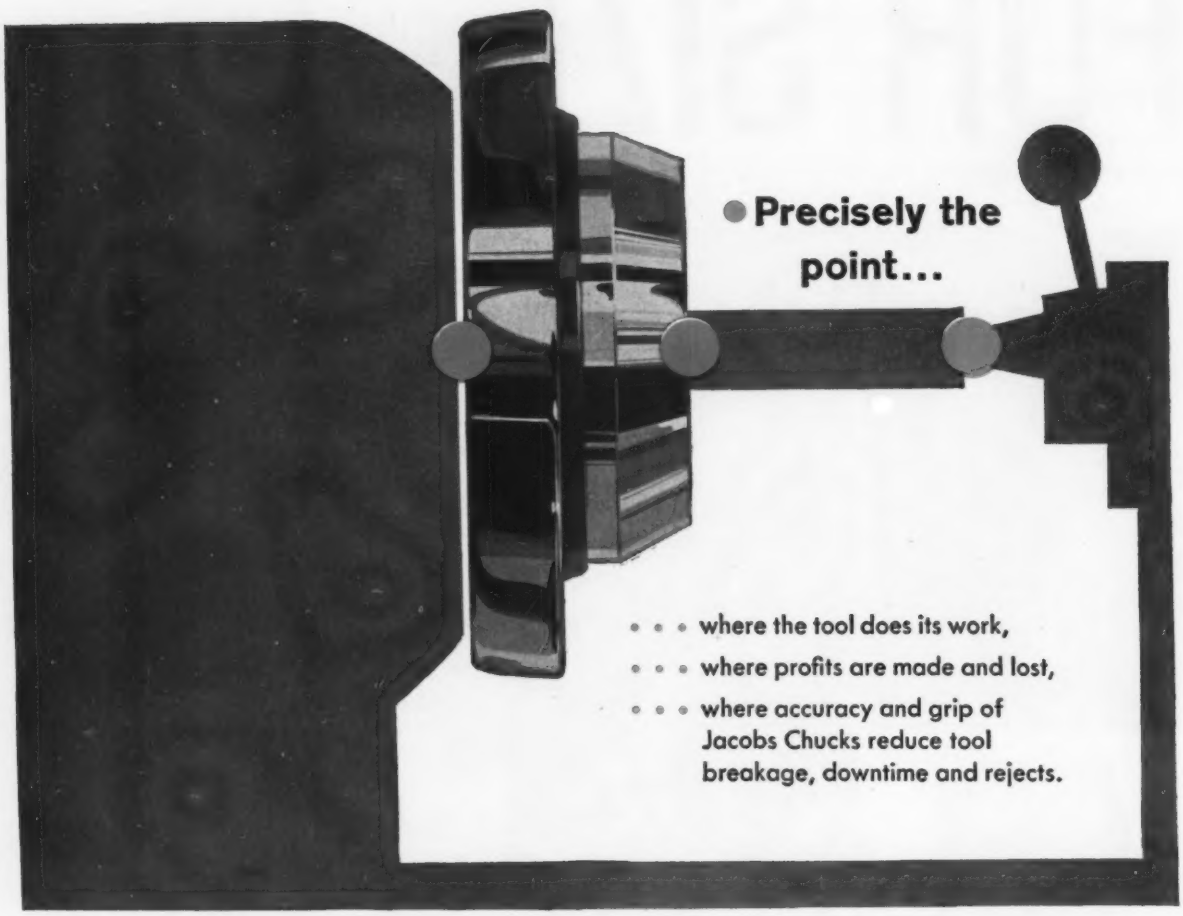
When you buy new tools or four factors come first

ACCURACY GRIP


● Precisely the point...
• • • where the tool does its work,
• • • where profits are made and lost,
• • • where accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

The Jacobs Model 50 is the world's most modern collet chuck. Model 50 and its entirely new series of Jacobs Rubber-Flex collets have been developed especially for Atlas, Clausing, Delta, Logan, Sheldon, South Bend and similar lathes. With Model 50 on your lathe you get a lot more for less.

ACCURACY is greater with Model 50 because collet jaws are always parallel and maximum run-out is .001" T. I. R. at the nose, when properly mounted.

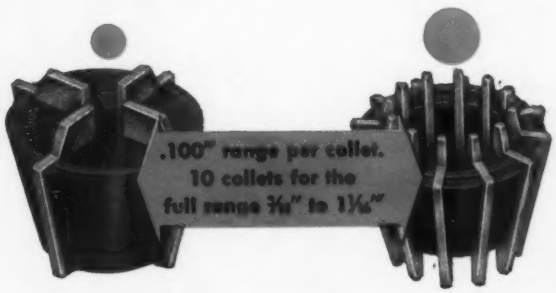
GRIP is greater because the extra long collet jaws have tremendous torque capacity.

modernize your old ones at the chucking end

RANGE PRICE

COMPLETE SET OF 10 RUBBER-FLEX COLLETS CHUCK ANY BAR BETWEEN 3/32" and 1 1/16"

RANGE is greater because the 10 Rubber-Flex collets in this new series cover a greater bar stock range than **63 old-fashioned split steel collets . . .** .100" range per collet.



PRICE **is revolutionary!**

$70.00 Model 50 Collet Chuck

$65.00 Complete set of 10 Rubber-Flex Collets

This performance at these prices proves the point. You can't afford not to modernize your lathes with Jacobs Model 50 and Rubber-Flex collets.

See your Jacobs industrial supply distributor. Give him the opportunity to prove the facts with a demonstration at your desk! Call him today. If you'd like further details before you call, write Jacobs, Department 196 at the address below.

Jacobs CHUCKS

THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT

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NUMERICALLY CONTROLLED HYDROPTICS

production pace set by machine, not by operator

New CN4 SIP Numerical Control provides automatic precise control of Hydroptic 6A/7A Machines in drilling, boring, tapping and milling operations at two to three times the productivity of manually operated machines.

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- MAPI Cites Overseas Advantage
- Machine Tool Stockpiling Down
- Military Procurement Discussed
- Washington Briefs

Keeping up with Washington

Loring F. Overman

THERE IS INCREASING EVIDENCE that the machinery and machine tool industries may be among early beneficiaries of the new Administration's efforts to bolster the economy. First of these indications is the attention being given to industry's pleas for revision of depreciation schedules for tax purposes. A second factor is an item of some $8,400,000,000 by which the committed federal outlays for fiscal 1961 may exceed the budgeted total.

A third element—of direct interest to metalworking industries—is the likelihood that defense procurement will be up to $15,300,000,000 in fiscal 1961, compared with $12,100,000,000 in 1960. A fourth factor is the increasing emphasis being placed upon strategic missile systems, as compared with manned bomber systems. The change involves complete retooling of many defense plants, as well as stepped-up conversion in others.

MAPI Cites Overseas Advantage

The Machinery and Allied Products Institute is again among the leaders in keeping Washington informed of industry's need for revision of capital-goods depreciation rates. Latest MAPI research documents dramatically emphasize the disparity between tax depreciation systems here and abroad.

The MAPI study covered only productive equipment, exclusive of buildings and facilities, in Great Britain, Canada, West Germany, Sweden, France, Italy, and Japan. The study showed the amount that can be written off (1) in the first year of service and (2) in the first three years of service.

In two of the countries studied (Japan and the United Kingdom), the first-year write-off exceeds 50 per cent, as compared with 13 per cent in the United States. In two other countries (Sweden and Italy), the first year write-off exceeds 30 per cent. Two countries (United Kingdom and Sweden) permit a 70 per cent recovery during the first three years of service, while Japan and Italy allow 60 per cent. The American equivalent is 35 per cent.

The MAPI presentation observes that both presidential candidates, during their campaigns, were in complete agreement that there should be liberalization of tax allowances to stimulate productive investment. "It is well to recognize," observes MAPI, "that many countries have gone frankly and openly for incentive, as distinguished from realistic depreciation. Write-offs of 50 per cent or more in the first year of service are obviously not justifiable as a realistic measure of capital consumption, and the countries that offer them make no attempt to so justify them. They are offered as a matter of national policy, to stimulate private investment."

The MAPI discussion closes with the recommendation that now is the time for corrective action. It points out that several suggestions made by industry should be weighed carefully in the light of conditions and their effect on both the economy and the Treasury.

Machine Tool Stockpiling Down

Possibly reflecting the transition period in weapons selection, stockpiling of machine tools will be curtailed in fiscal 1961 and 1962, according to present budget information. Machine tool allowances for each of these years is $505,000, compared with $2,196,000 for 1960. Total stockpiling of strategic items, including machine tools, will reach $1,540,000,000 by June, 1962, up from $1,454,000,000 last June.

Military Procurement Discussed

The Defense Department, under its new Ford-trained Secretary McNamara, is to be asked to reform present buying practices through more competitive bidding, greater centralization, and more efficient handling of surpluses. Senator Paul Douglas (D-Ill.) is particularly interested in the plan. He estimates that "as a minimum, two to three billion dollars per year could be saved."

Senator Douglas considers as "scandalous" the fact that 86 per cent of all military contracts are now negotiated rather than let by competitive bidding. He charges that a congressional mandate for reform in this field, expressed in the 1961 defense appropriations bill, "has been met with little more than a series of justifications of the existing system."

Washington Briefs

The final economic report sent to Congress by President Eisenhower emphasized the need for a selective tax revision to promote incentives and to maintain the vigor of the enterprise system. The recommendations served as an ideal backdrop for reintroduction of the Herlong-Baker proposals calling for five annual reductions of income-tax rates for individuals and corporations. For individuals, the minimum rate would be 15 per cent, and the maximum, 47 per cent instead of the present 91 per cent. For corporations, the top rate would come down one per cent per year from the present 52 per cent to 47 per cent.

Security and space programs will take $8,400,000,000 of the total $9,443,000,000 allocated to research and development for all government departments during fiscal 1962. The Government is said to support over 60 per cent of the nation's research and development programs, with industry financing one-third, and the balance supported by educational institutions and state and local governments.

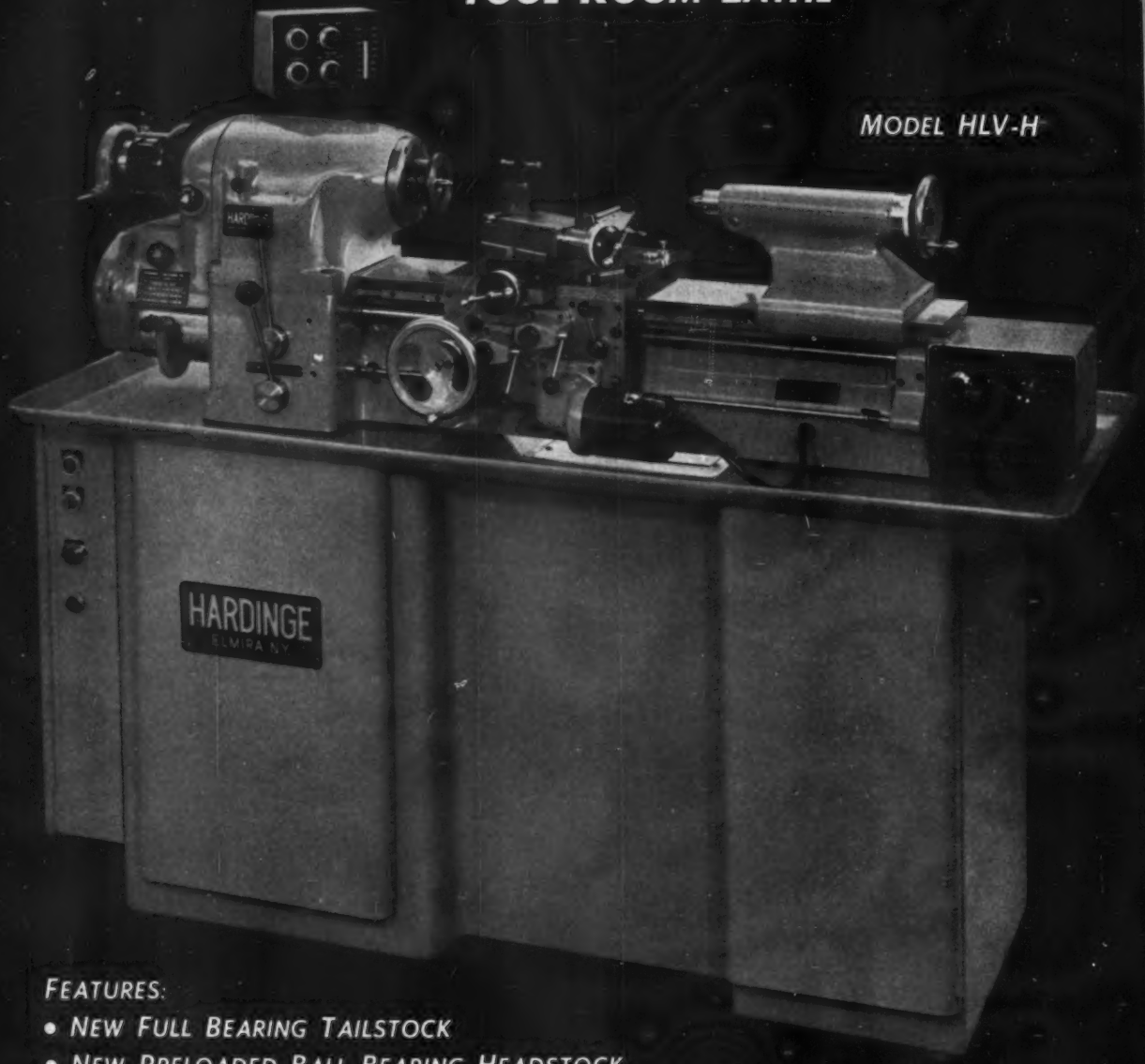
During the first two days of the Eighty-Seventh Congress, 2000 bills were placed in the House of Representatives hopper, and 225 were introduced in the Senate. It is expected that more than 10,000 legislative proposals will be made before the session ends.

THE **NEW**

HARDINGE
ELMIRA, N.Y.

HARDINGE HIGH SPEED TOOL ROOM LATHE

MODEL HLV-H



FEATURES:

- NEW FULL BEARING TAILSTOCK
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- NEW ELECTRIC INTERLOCK FOR SPINDLE LOCK PIN
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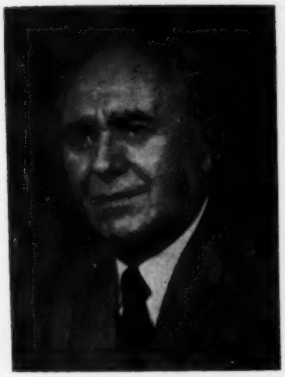
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Machinery

MARCH 1961



The Technical Expert— His Responsibilities and Needs

WITH the increasing complexity of metal-manufacturing operations, the need for experienced and highly qualified technical experts is greater than ever. Men of broad experience and recognized ability are necessary to handle the average company's technical problems. Their opinions and recommendations carry the greatest possible weight. This is true even in the financial area when the opinion of a technical expert is needed to decide whether or not the spending of large sums of money on new production equipment would be justified by the savings achieved in production.

Today the technical expert in the metalworking industries must keep himself informed on a myriad of new materials; new and far more complicated manufacturing equipment which, in some cases, did not even exist a decade ago; and radically different manufacturing processes.

He should know about modern inspection equipment, especially if he is employed in the field of electronics, where parts must meet tolerances specified in millionths of an inch. In an increasing number of plants he must have a revised conception of quality control as coordinated in the new term "reliability."

It is imperative that the technical expert be proficient in all of these matters so that his plant can achieve maximum production efficiency. With today's high cost of materials and labor, and other factors that squeeze corporate profits, it will be possible for many businesses to survive only if production efficiency is materially increased.

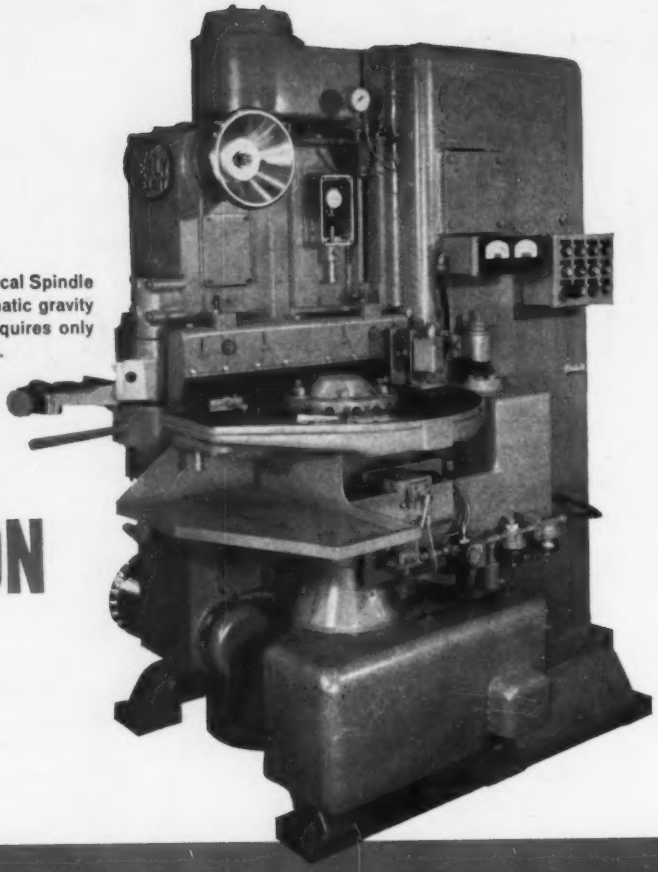
It is up to the technical expert not only to decide when obsolete equipment should be replaced but also to recommend the type of equipment to be used in the replacement. The financial men of a company naturally decide how much money can be spent on an equipment-replacement program, and such programs must carry their official approval. However, for the choice of equipment to be bought they must rely almost entirely on the technical expert, whose decision must necessarily be based on knowledge of the most suitable equipment available from the standpoint of final product cost and quality.

How can the technical expert keep himself informed about latest developments in his particular sphere of interest? How can he learn what is being done in shops around the country where other experts are meeting problems similar to his own?

Technical magazines are the answer. By supplying the information that technical men need, they are of greatest possible value to both the individual expert and the industry as a whole. To render this service effectively is the reason that MACHINERY maintains its character as a technical publication without dilution.

Charles O. Herb

EDITOR



Besly DV2 Double Vertical Spindle Disc Grinder with automatic gravity feed and discharge. Requires only 8-ft. by 8-ft. floor space.

for

PRODUCTION DISC-GRINDING

...Better see Besly! **DOUBLE VERTICAL GRINDERS**

The Besly DV2, illustrated is representative of the new line of double-vertical spindle disc grinding machines now being manufactured in our South Beloit plant. Designed for production use, this unit is shown grinding top and bottom of $\frac{3}{8}$″ thick throw-away carbide inserts at a rate of 3,000 passes an hour. Three passes are required to remove .016″ of stock. *Tolerances on the final pass are held within .0003″ for flatness, parallelism and size, with a 4 micro-inch finish.*

The DV2 will grind parts that range from .050″ to $2\frac{1}{2}$″ in thickness and .375″ to 3″ in diameter. In addition to grinding carbides or hard ceramics that require diamond abrasives, the DV2 also grinds stampings, plastic parts, alnico magnets, bearing races, coil springs, carbon parts and the like with resinoid-bond abrasive discs.

WRITE FOR THIS NEW illustrated catalog describing Besly Disc Grinders.

BESLY®

BESLY-WELLES CORPORATION

120 Dearborn Avenue, South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps® • Drills • Reamers • End Mills
Tool Bits • Gages • Carbide Tipped Tools • Blanks • Inserts • Holders

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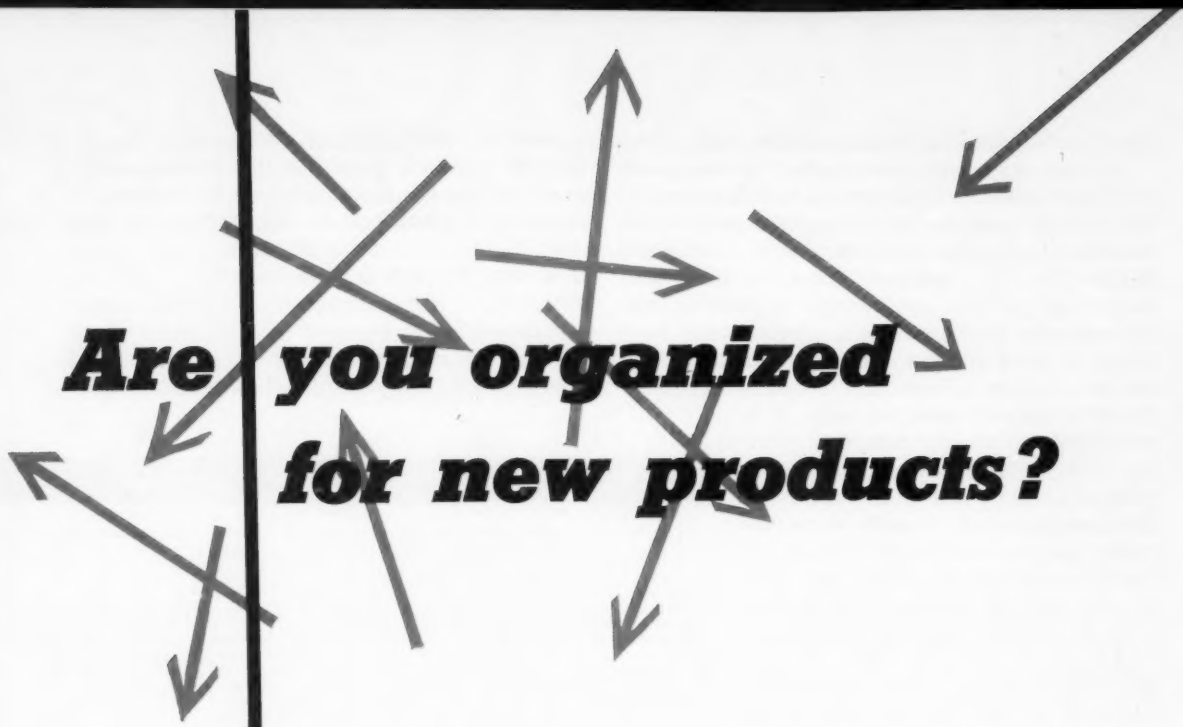


Are you organized for new products?

New products can assure the continued life of a company. The proof of this statement is the fact that almost all product designs have a finite life—most of them no more than two to five years. The life of some can be measured in days. Only basic materials have a substantially longer life. There is no reason for a company to exist if it does not have at least one saleable product. Yet, in spite of its obvious importance, it is surprising how many firms ignore this fact and leave this vital need to almost pure chance. Corporate soul searching is necessary

DELMAR W. KARGER
Head, Department of Management Engineering
Rensselaer Polytechnic Institute, Troy, N. Y.

WAVING a magic wand will not assure the successful engineering, production, and marketing of new products that can be sold at a profit. The desired result can only be achieved through hard, imaginative, concentrated, well-planned, and integrated effort by all elements of a company. It requires sound organization. Creativity is also a powerful factor.

Before one can effectively plan for a new product, much less integrate planning effort, it is necessary to comprehend what is involved in launching a new item. Management must understand the "facts of life" of a new-product development program as they relate to marketing considerations; manufacturing requirements; and, even more specifically, to sales. Only then can a company examine a successful means for integrating the interests of the several groups that

must be involved in so comprehensive an effort.

In connection with new-product developments one hears such trade jargon as: new features, an innovation, new product, expanded market, diversification, and kindred terms. Fig. 1 attempts to show the relationships that may exist between degrees of product newness and degrees of market newness. It shows how a company can have a new product without affecting the market; and conversely, how a firm can have or achieve new markets without new products. It is notable that a modification of an existing product may have a greater impact on a company's sales structure or its manufacturing costs than an entirely new product design. Because of this phenomenon it is suggested that all engineering programs, including research and development, be examined in the broad sense. Where it appears appropriate, action should be taken to handle the situation in a manner that recognizes the importance of product design and the implications involved. Even though a project involves only a modification of an existing product, it may require all of the special handling that an entirely new product would obviously need.

In a sense, this activity involves a function which modern management calls product planning. Product planning is at the heart of business strategy. It affects and is affected by every activity of the business enterprise, and should be based on a realistic evaluation of all the company's objectives, its corporate strengths, and weaknesses. In a strategic sense, any form of product differentiation must be treated as a phase of product planning. From this viewpoint, therefore, product planning may comprise any or all of the operations listed under "Methods of Product Differentiation," Fig. 2. Each of these planning activities must be so oriented as to satisfy both the immediate and the future needs of a company. Therefore they must also be continually modified to keep up to date.

Product Obsolescence

It must be emphasized that changes in environment due to technological developments are rapidly accelerating. Few executives realize how rapidly. One measure of the pressure exerted by technological development (and of the effort which goes into the development of new products) is the growing expenditure for research and development. Fig. 3 shows dramatically the growth of R & D in the United States. In spite of this, it is only in recent years that companies have begun to establish and maintain a product-planning function at high level.

While the average over-all return from R & D is large, over a ten-year period individual projects

INCREASING MARKET NEWNESS

Expand sales into new classes of customers	No change in product, but new classes of customers reached. Probably involves finding some new uses for product. This may occur without expansion of sales to old classes of customers. This type of market expansion could even occur when sales to old classes of customers are decreasing. Finding new uses for product may involve technical or new product assistance.	No change in product, but new classes of customers reached. Probably involves finding some new uses for product. This may occur without expansion of sales to old classes of customers. This type of market expansion could even occur when sales to old classes of customers are decreasing. Finding new uses for product may involve technical or new product assistance.	Expanded sales to new classes of customers will not automatically occur. If such expanded sales occur it will be principally for same reasons and in same manner that this could occur for an unchanged product.
Strengthened market in existing classes of customers	Remerchandising and/or other sales effort to expand sales. Sell more customers of the same types previously served.	Remerchandising and/or other sales effort to expand sales. Sell more customers of the same types previously served.	Market coverage for present classes of customers likely to increase due to improvements in product characteristics and merchandisability. Since there is an effect on the product characteristics there could be an allowable effect on price—however, the general aim is always to reduce cost, increase profit margin, and only increase price when absolutely necessary.
No Market Change	No change in product characteristics and no change in market penetration.	No change in product characteristics and no change in market penetration.	Positive market change likely to result—however, some adverse market parameters could hold sales constant, or even let them slip.
	No Product Change	Product characteristics remain same but changes in components, formulation, production techniques, etc. are made to keep costs in line and quality at same relative level.	Improvement in product characteristics to yield greater utility to customers and/or increase merchandisability through improved packaging, etc.

INCREASING

Fig. 1. Relationships between increasing product

have a high probability of yielding little or no profit. In spite of the poor short-range prospects for individual projects, most managements are well aware that each dollar of R & D expenditure will yield an annual return of 100 to 200 per cent on the investment by the end of twenty-five years. Thus, the expenditure of $100,000,000 for R & D in 1959 should yield a return of between $100,000,000 and $200,000,000 over the initial investment by 1984, at present rates.

In effect the marketing function is here concerned with what is essentially a new product—almost complete with all the problems associated with a new product.	Opening of new markets because of the introduction of a replacement product does not automatically follow. Unless the changes in characteristics and/or the resultant price obviously opens new markets—new applications must be actively sought and aggressively exploited when found in order to reach new classes of customers.	The addition of new items or products to a given product line can make it possible to attract new classes of customers—especially where a previous incomplete line made it necessary for certain classes of customers to buy from several manufacturers. When this barrier is removed—new classes can often be reached. This same device also often operates to increase market penetration with existing class of customers.	Sales of new products in a new product line obviously mean reaching new customers—and generally new classes of customers. This situation represents the extreme opposite from "no product change —no market change."
Not applicable—no previous market.	The replacement product usually lends itself to a remerchandising campaign resulting in a greater penetration of existing markets.	The introduction of such new products strongly tends to strengthen sales to existing customers.	Not generally applicable—no previous market. See above comment.
Not applicable—no previous market.	Depth of market penetration could remain constant. However, the product changes involved are drastic enough to likely change market penetration. An example of a less drastic change which possibly had little effect on market penetration was the substitution of synthetic resin for shellac in S. C. Johnson's Glo-Coat which occurred in 1950.	Not applicable—no previous market.	Not applicable—no previous market.
Major modification of product characteristics so as to essentially aim at new classes of customers for entirely new applications. Company might continue producing old product for existing class of customers.	Replacement of an existing product using new technology. Example: replacing tube-type portable radio with transistorized model.	Product line extension. Example: development by S. C. Johnson & Son, Inc. of Emeral. This new product is a floor cleaner which extended their maintenance product line in 1953. The miniature electrolytic capacitor introduced by Magnavox late in 1957 is another example.	Diversification—the addition of a new product in a new product line. Example: (1) the introduction of Raid, a dual-purpose insecticide by S. C. Johnson, Inc. (2) the introduction by Magnavox of a high speed sampling switch.

PRODUCT NEWNESS ——————→

newness and increasing market newness.

Basic Program for Product Planning

In establishing a product-planning program, each company must take advantage of its own strongest characteristics. However, there are three basic requirements or steps that are applicable to all companies:

1. Determine and evaluate corporate strengths and weaknesses.
2. Determine long-range over-all business goals, including long-range financial, technical, production, and marketing objectives.
3. Design and establish the product-planning function, including specific and detailed plans and policies based on the results of Steps 1 and 2.

While the scope and detail of the problem presented by each step will vary with the individual company, the requirements are universal and, until implemented, will hinder progress. In fact, without accomplishing these three basic steps, any product-planning group can waste most of its effort. This is a loss few firms can afford.

Details of Basic Step I

The determination and evaluation of corporate strengths and weaknesses is certainly basic. This study includes, but should not be restricted to, the following:

(a) Corporate board;

(b) Executive talent;

(c) Quantity and quality of general and professional manpower, including special talent strengths in pertinent areas such as scientific, creative engineering, skilled craftsmen, common labor, etc.;

(d) Financial position and capabilities;

(e) Plant facilities;

(f) Markets, marketing positions;

(g) Corporate image.

These are not just casual items that someone dreamed up. Take, for example, the make-up of one's own corporate board. Is the outlook of the board members young or old? Are they aggressive and willing to take calculated risks? Or are they so conservative that they try to avoid all speculation.

Consider this in relation to a real example. The American Machine & Foundry Co.'s corporate board did a lot of soul searching before it embarked on the project of developing and marketing the automatic bowling-pin spotter. At various stages of this project members checked with consultants. Quite a number of the experts indicated that they felt the board was making a mistake to go ahead with the project. In fact, several board members were told that they were likely to jeopardize the very existence of their company if they followed this "foolish" goal. In spite of this, they went ahead—one might say they "took a chance." It is no secret that this venture paid off handsomely. Today the pin spotter is a recognized major product of AMF and is bringing in substantial profits.

In a similar manner one might explore board member attitudes. How do your board members feel about mergers and acquisitions? What is their general perspective? Is the board dominated by an individual or group, or by any set of biases or prejudices which may adversely affect new product planning? Here is an example of how important open-mindedness can be. The author frequently hears of cases where a profitable licensing agreement was completely worked out. However it was not implemented because a powerful member of the board of directors said, "I don't want anything to do with the licensing firm." Does this sound odd? It may sound peculiar, but it is an everyday example of the effects of bias.

Is the cumulative executive talent of the board, and of the company as a whole, experienced and broad enough to guide development and marketing of new product lines or the entry of the company into a completely new field? This question is much easier asked than answered and implemented. Here is a good area for some corporate soul searching.

Fig. 2

METHODS OF PRODUCT DIFFERENTIATION

- Addition of new functional features
- Changed styling of product
- Changed packaging
- Improvement in service or warranty
- Expansion of product lines
- Expansion of product size range
- Reduction of models for standardization
- Diversification into new product lines
- Improved quality
- New pricing policy
- Locate or determine new applications for present products
- Locate and develop new markets
- Improve method of distribution
- Construct improved facilities
- Improve product name
- Improve connotation of brand and/or company name

Manpower for a New-Products Program

While the subject of manpower evaluation is common, here is a check list of some important items to consider:

(a) Managerial personnel. What are their qualifications on the basis of age, present ability, special talents, and potential growth?

(b) Depth of management talent for present managers.

(c) Engineering and scientific talent. What is the company's engineering strength in terms of number and quality of engineers by field, depth in field, and specialties?

(d) Professional talent other than engineers and scientists. What quality, quantity, and variety of talents—such as industrial designers, financial specialists, salesmen, marketing specialists, and production and industrial engineers—are available?

(e) Technical supporting personnel (laboratory assistants, computer programmers, engineering assistants).

(f) Skilled, semiskilled, and unskilled labor. What quality and quantity are available within the company? What potential reserves are there in surrounding areas? What are the labor history of your area and the labor union relation?

(g) Geographical dispersion of plants and employes.

(h) Compensation practices.

(i) Morale and loyalty of employes.

The various subheadings are self-explanatory to an experienced manager. For example, it is obvious that the depth of management talent, or backup for present managers, assumes great importance when embarking upon an aggressive new-product program. If a firm does not have the necessary reserve personnel, then it must attempt to acquire the extra people that such a program requires. This can be done, but it is not often realized that the integration of such talent is far more successful when it is accomplished within the framework of a substantial amount of existing talent.

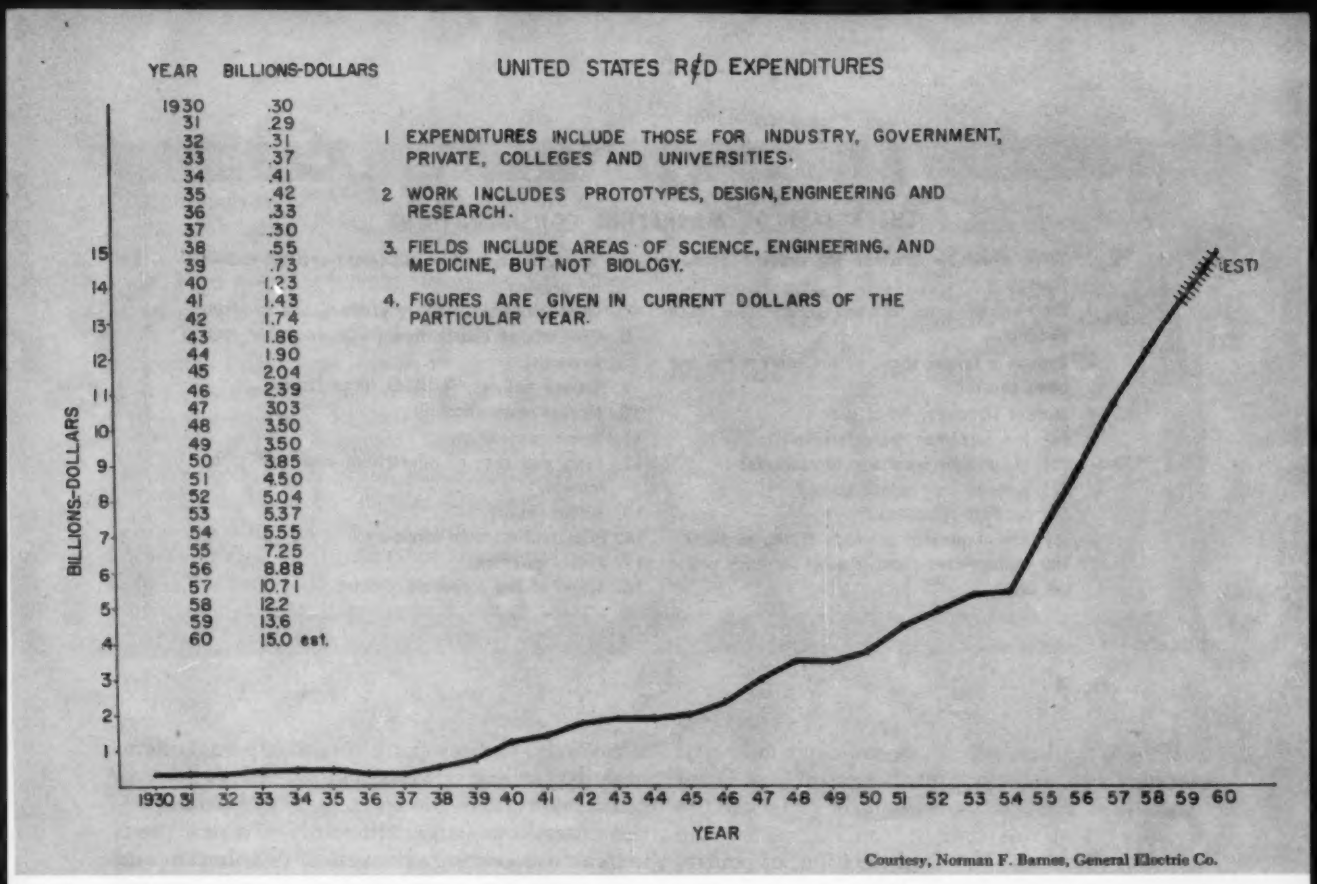


Fig. 3. The growth of research and development expenditures in the United States since 1930.

Different new products require different kinds of talent. Consequently, a company's evaluation and inventory must encompass its whole talent: engineering; scientific; marketing; sales; manufacturing; production control; traffic supporting personnel; and semiskilled, and even unskilled, labor. While manpower is under examination it is also advisable to look objectively at such basic items as compensation practices, the morale and loyalty of employes. Certainly a company stands a better chance of success if the morale and loyalty are high. It is a difficult item to evaluate, and some soul searching will be needed. Not only do high morale and loyalty help in a new-product development program, but they also help the sale of existing products.

Evaluation of Finances

There should be included in the study an evaluation of the company's capital structure, retained income, credit and availability of capital, contingent liabilities, flexibility of fiscal policies, and obviously related financial considerations.

A case in point is illustrated by returning to the American Machine & Foundry Co., and seeing how the bowling-pin spotter was financed. AMF had to increase its long-term debt from about $2,000,000 to over $100,000,000 in a period of ten years. During this period the company was spending more money than it was taking in. The firm actually sold part of its plant facilities and leased them back in order to get its hands on cash. It required a sound financial concept to embark on the pin-spotter project; and, even more importantly, it required sound financial policies to carry such a program through to a successful conclusion.

Plant and Equipment Considerations

The evaluation of facilities includes the consideration of such items as:

(a) Number, size, location, type, layout, condition, and degree of obsolescence of manufacturing plants, warehouses, and offices.

(b) Types, kinds, condition, degree of obsolescence, and adaptability of manufacturing equipment.

(c) Accessibility to transportation, raw materials, and markets.

(d) Operating and maintenance costs.

(e) Ownership or leasing arrangements.

(f) Excess capacities (by classifications).

(g) Availability of adequate amounts of water, power, fuel, and other required utilities.

CHECK LIST OF MARKETING CONSIDERATIONS

1. Total available market for present product lines.
2. Fraction of total market secured for each product.
3. Reason a larger share of the market has not been secured.
4. Market structure. What are:
   (a) the customer characteristics?
   (b) geographic locations of markets?
   (c) price-volume relationships?
   (d) product substitutes?
   (e) life of present products in the market?
5. The replacement parts market for each product line.
6. Seasonal and other important cyclical factors by product line.
7. Competitive position by product, and in total.
8. Channels of distribution (types, number, and strength).
9. Service policies, facilities, organization.
10. Market research ability.
11. Brand recognition.
12. Type and cost of advertising and sales promotion.
13. Service policy.
14. Price and discount structure.
15. Patent position.
16. Scope of the corporate charter.

Fig. 4

Here is a place where a company's industrial engineer can make a contribution of significant magnitude. The industrial engineer can make the inventory and can suggest conclusions for the board of directors. The final decision, of course, must rest with the board. In a similar manner, the personnel department normally would make the detailed inventory of manpower and draw on subgroups within the organization for an evaluation of the strength and weaknessess in each of the areas involved.

The industrial engineer certainly can assist materially in guiding the establishment of the product-planning function. It is a job normally assigned to either a high-level staff function, a staff specialist, or a consulting management engineer firm.

Fitting the New Product to the Market

The market structure study should determine customer characteristics, the geographic locations of the company's markets, price-volume relationships, possible product substitutes, and the life of present products in the market, among contributing factors. By relating this information to that determined under Item 8 in Fig. 4 (channels of distribution, by types, number, and strength), it is possible to form a picture of whether the new product presents a minor or a major marketing problem. Take, for example, the now-familiar AMF pin spotter. The firm had no channels of distribution that reached bowling alley proprietors or bowling enthusiasts. This meant setting up an entirely new marketing organization. Further, in order to expand the use of this product, they had to promote bowling as a pastime. The company literally spent millions of dollars selling bowling, not necessarily in association with AMF pin spotters, in a "bread-upon-the-waters" campaign. Obviously, if a new product can use existing channels of distribution and marketing, the company has a much greater likelihood of success. Some experts say that the chances are multiplied by at least a factor of two, and other authorities use a factor of three to four.

Cyclical Justification for New Products

If a company's present products have seasonal or other important cyclical factors, it is typical to try to eliminate these by introducing new products that compensate for slow periods. For example, electrolytic capacitors, for use in radio and television sets, are in maximum demand from approximately August to December. With a consequent low in the late winter and spring months, capacitor companies therefore should expand their lines to include a kindred product, such as electrolytic motor-starting capacitors, which have a maximum demand from December through July. Thus the new line is used to offset the unfavorable cyclical demand for capacitors sold to radio and television manufacturers.

Naming the Product

Brand recognition and corporate image are of more importance than the average person thinks. For example, a market survey firm tried to find the most popular and best regarded shoe polish. While their survey placed Esquire brand in position 1; in position 2 was S. C. Johnson & Sons'

shoe polish. Oddly enough, S. C. Johnson & Sons did not make a shoe polish at the time. The survey obviously was rigged by placing the company's name among the manufacturers of shoe polish as a sleeper to test whether this product would be a good new field for expansion. Since the survey, Johnson has begun to market a shoe polish. It is a reasonably safe assumption that if the product is good, it will quickly assume at least a No. 2 sales position in the market.

In a similar vein, Proctor & Gamble acquired the Duncan Hines line of packaged foods so that it would have a brand name to use for marketing food products. Another firm that has employed a similar device is General Mills, which markets many of its food products under the Betty Crocker trade name, rather than General Mills, just because it conveys a better image to customers for certain kinds of products.

Details of Basic Step 2

The determination of long-range over-all goals for a business must include extended financial, technical, production, and marketing objectives. They should be related to anticipated company capabilities and future environment changes. Here are some of the main areas to be defined by the new-product survey:

1. Business prospects and trend directions.
2. Financial condition and structure of business in view of projected product plans.
3. Technical objectives as related to facilities, manpower, organization, and finance.
4. Plants, their location, other facilities, and general manpower required for new products in relation to raw materials and markets.
5. Marketing objectives, broken down by product lines.

The determination of long-range goals (Item 1) involves five major categories of consideration, the first being the business prospects and direction for the next ten years. Under this can be placed five subheadings:

(a) Projected technological, economic, and market trends.

(b) Horizontal and vertical diversification of product lines.

(c) Expansion of present product lines.

(d) Entry into new related and unrelated fields.

(e) Subcontractor entry into frontier fields, such as atomic energy, space flight, solar energy.

Decision on Item (e) often stems from the results of decisions on Item (a) and may require proof of capability.

Consideration of many of these items is related to research and development expenditures. Here is a brief guide proposed by R. C. Dale of the successful Nashua Corporation on the topic of research and development appropriations:

"(1) The first research dollar increment should be spent *because* the company is *in business;*

"(2) The second R & D dollar should be spent to improve existing products;

"(3) The third dollar should be spent for rounding the product line;

"(4) The fourth dollar increment should be expended to diversify *while still maintaining a thread of continuity;*

"(5) The fifth dollar should be spent in pure exploratory research;

"(6) The sixth dollar increment should be spent to diversify in new fields—fields having no thread of continuity with present products."*

The first dollar increment is spent because one has a direct responsibility to both stockholders and customers to maintain product position and to keep abreast of market requirements. A policy limiting R & D to such a minimum amounts to virtually standing still. This is a practical impossibility since a company normally either goes forward or else slips back.

Spending the second increment to improve the product is only one step beyond the bare minimum. Such a policy certainly does not convey the image of a progressive, dynamic company.

When a company earmarks some of its research expenditure to round out the product line, it is then *beginning* the establishment of objectives that are everyday routine among progressive companies. The objective is usually to take advantage of the company's distribution system,

*Karger, Delmar W.; *The New Product,* The Industrial Press, New York City, 1960.

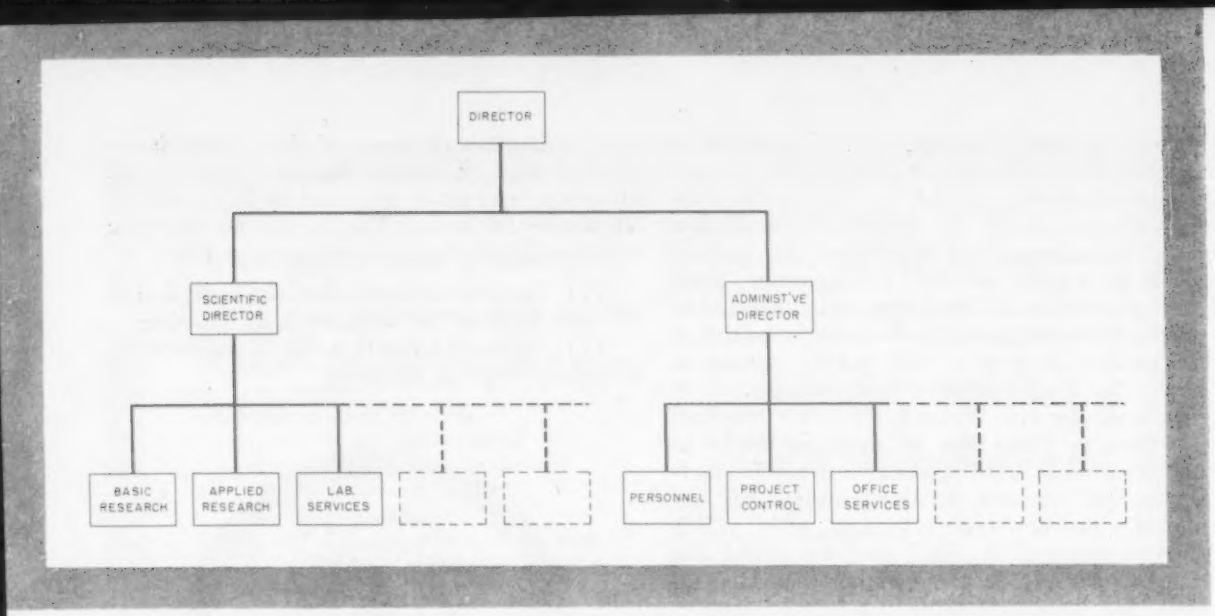


Fig. 5. Typical organizational chart for the research department in a large company.

which provides for, or demands, another compatible product; or else, take advantage of production facilities and skills which are adaptable to the efficient production of another compatible product.

Diversification with a "thread of continuity," the fourth R & D increment mentioned by Mr. Dale, is of utmost importance. A prime example of such diversification is the successful and profitable expansion of the Minnesota Mining & Mfg. Co. There is the golden thread of continuity running from product to product in this organization. Through their knowledge of abrasive material, and its markets, they moved into coated abrasives. Their knowledge of the resins employed in bonding abrasive wheels was used to make sandpaper waterproof. One of the expanded applications of the waterproofed sandpaper was its adoption by the automotive body trade. Through these firms the company learned of the need for masking materials. 3-M's first masking tape had a thermoplastic adhesive which made it necessary to use a hot iron in applying the tape. It was widely used in spite of this handicap because it filled a need. Not willing to rest on their laurels, the company recognized the need for a better product and therefore developed its pressure-sensitive adhesive tape, which has become a household item of practically unlimited uses.

Mr. Dale recommends that the fifth dollar increment of research effort be expended in pure exploratory research of an undefined nature. It was in this area that the 3-M organization developed its Thermofax copying process, which is today used in thousands of offices to make reproductions of documents. While it is true that more important scientific advancements have been made in undirected research than in research with a specific objective, the degree to which a company can, or should, follow this path is dependent upon many factors. A decision regarding proceeding with such expansion should be reached only after serious study and analysis by top management. Without top management's unqualified interest and support, a pure research program has small chance of success.

Spending research dollars to diversify into new fields with no thread of continuity is extremely difficult and dangerous. It is usually best for a company to achieve this kind of diversification through purchase or acquisition of other companies. The type of thinking that has been indicated as necessary for the first category of objectives needs to be applied to the remaining four.

But merely defining objectives does not automatically result in the development of new products that will be sold at a profit. It is an important step, but action must be taken to implement and move toward the planned objectives. This means that the objectives must be implemented. It is what is involved in Basic Step 3, organizing the product-planning function.

Product Planning

Assigning the product function does not mean merely the giving or project responsibility to a capable person and then promptly isolating him in an office to plan and think. Too often companies do exactly this, feeling that once having assigned the responsibility, they have accomplished the task. It not only seems foolish—it is foolish!

Successful assignment of the planning function requires a careful and well-organized consideration of the company and its organization. What is best for one company may be wrong for another. The nature and duties of any organization staff group to which this responsibility is delegated, the group's status, the scope of its activity, and its liaison with the other organizational elements of the company are determined largely by three factors, as follows:

1. The organizational placement of the planning group Fig. 5.
2. The company's internal and external characteristics.
3. The talents and abilities of the individuals in the group concerned.

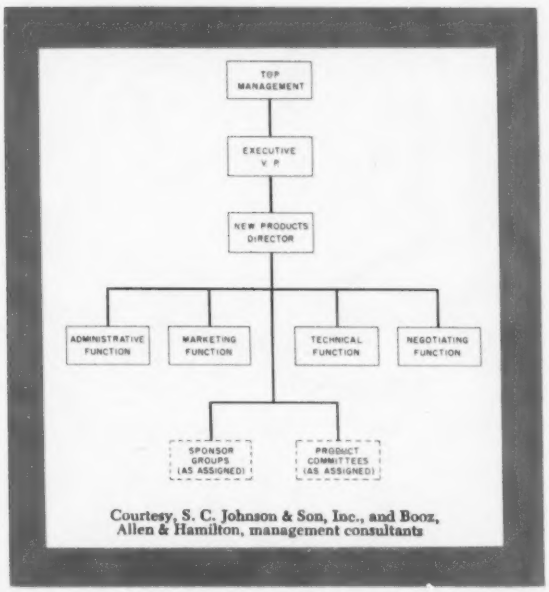
Product development and planning, being so vitally and directly concerned with implementing the company's future plans and objectives, require that the individuals concerned therewith have free access to top management. Too often this is true only in theory, when they report to anyone but the firm's chief executives. If they are insulated from the top executives, the objectives are almost sure to be unreached and the individuals concerned find themselves completely frustrated.

In the small-to-medium-size company, one sure organizational approach is the initial appointment of one person to handle the duties and responsibilities involved. He then must be supplemented with additional qualified personnel as required. This arrangement works only if the man possesses a wide variety of talents. It probably is the best approach—but the man must be carefully closen. Keep in mind the prerequisite that his work will be most profitable if it is a full-time job, not be littered with a load of other responsibilities.

In larger companies, one approach used is to set up a top product planning and development staff function, Fig. 6. Here, instead of being a one-man operation, it means appointing function specialists in engineering, manufacturing, marketing, and related areas. A more common approach to the problem is to make it a committee activity. However, this is a weaker method and will not work unless the committee is continuously stirred up by a top company executive. Product planning and new-product development are doomed to failure if responsibility for product planning and development is not given a position of major importance and if it is not organized and staffed in the best possible way.

Once having organized the new-product function, it is obvious that the next step is to develop and find new-product ideas. Obviously, other factors—such as the determination of approximate market; the financial potentials for selection of the best ideas; and the pursuit of manufacturing, marketing, and product service activities—are all important and must be carried out. Finally, management engineers and company executives must establish measures and standards for the evaluation of results. They must measure the success of each of the mentioned activities and improve the product planning and development program in terms of these measurements. The project results in a lot of work, but it is work that can pay off in handsome profits provided that the right steps are taken along the way.

Fig. 6. Typical organizational chart for new-product development in a large corporation.



Courtesy, S. C. Johnson & Son, Inc., and Booz, Allen & Hamilton, management consultants

Modern production methods for bulk-handling equipment

RAYMOND J. AMTMANN, Manager
Standards & Methods Department
Hewitt-Robins Inc.

THE MANUFACTURING of equipment that has literally rolled away mountains is the modest boast of the Conveyors Division of Hewitt-Robins Inc., Passaic, N. J. This company, which has been designing and fabricating bulk-material handling machinery and conveyor systems for nearly three-quarters of a century, can now claim another achievement—improved and more economical production through the use of modern methods and machine tools.

The various types of vibrating machinery manufactured by the company rely upon a combination of eccentric shafts and counterweights to provide the necessary motion required for each specific contract application. The shafts, which range in size from 4 to 12 feet in length and 12 inches in diameter, are turned from hot-rolled shafting or forged blanks. Since a considerable amount of metal must be removed, any improvement in tooling and/or machining techniques would naturally result in substantial savings for the company.

Recently, a change-over from the standard brazed carbide tool to indexing type throw-away carbide inserts and the adoption of a shock-resistant grade of carbide (Vascoloy-Ramet Grade VR-77) have resulted in both increased stock removal and a doubling of tool life while still maintaining the same quality standards. Large shafts are turned at a feed of 0.026 ipr, at a depth of cut of from 3/4 to 7/8 inch and a speed of 300 sfpm.

Similarly, face-milling cutters equipped with indexing type throw-away carbide inserts are being used for many operations. A typical example

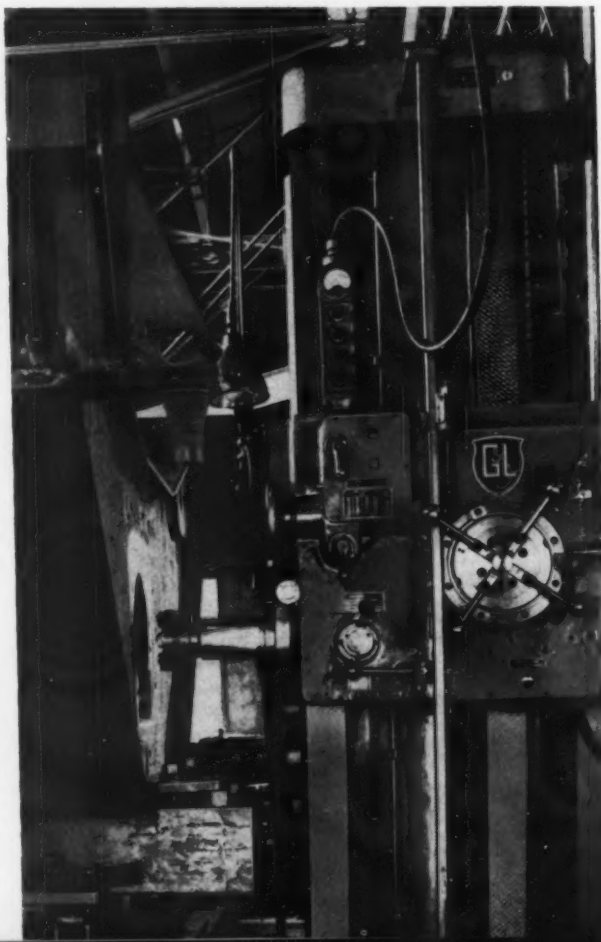


Fig. 1. In face-milling bearing-housing seats on this live frame for a heavy-duty car shakeout unit, the use of cutters equipped with indexing type carbide inserts has reduced machining time and has improved the finish and flatness of the surface obtained.

Here's how one builder of bulk-material handling systems has reduced costs by adopting improved manufacturing techniques

is the machining of the bearing-housing seats on the 7500-pound "live" frame of a heavy-duty car shakeout seen in Fig. 1. Previously requiring two and one-half hours to machine with high-speed-steel cutters, these bearing-housing seats are now milled in fifteen minutes at a cutting rate of 550 sfpm. The operation, which results in an improved surface (32 to 64 micro-inch finish) that is flat within 0.001 inch, is performed on a Giddings & Lewis horizontal boring mill.

A recent acquisition by the company to further improve production and reduce costs was the Wiedemann thirty-station turret punch press illustrated in Fig. 2. This machine has an 80-ton capacity and is used to punch holes up to 7 inches in diameter in 1/4-inch thick mild steel and smaller-size holes in up to and including 5/8-inch thick plates of the same material.

The machine is equipped with a direct measuring gage and table which can normally handle plates up to 72 by 200 inches in size and larger plates with minor setup revisions. The operator rides on a platform which moves in and out with the work-piece as it is being positioned for each

Fig. 2. Holes and cutouts in steel plates up to 3/8-inch thick are pierced by this 80-ton turret punch press. Work-piece is positioned in accordance with a chart, thus eliminating layout.

punching operation. The work-piece can be moved horizontally—both in and out and left and right—in relation to the working punch station by means of two power-assisted, graduated handwheels. Plates are positioned and punched from information on special punch charts which are prepared in advance by the methods department. This eliminates the necessity of laying out the plate.

In the operation the work-piece is first located to establish zero point and then clamped to the machine. The previously prepared chart is placed on a special drum; it is then read to determine the proper size punch and hole location along the two horizontal coordinates. Each handwheel is then rotated to locate the plate in accordance with these readings. The average time required to locate the work-piece for the punching operation is from five to ten seconds. When the work-piece is in position, a foot-switch is activated by the operator to trip the press.

This switch also rotates the chart drum so that the punch size and dial settings for the next punching operation are in position to be read. Although the smallest graduations on the operating dials of the work-table represent 0.020 inch, hole positions can be estimated to within plus or minus 0.005 inch. The part being punched in Fig. 2 is a vibrating machine side-plate and is made of 1/4-inch thick mild steel. When a number of smaller plates are required, they are often made from one large plate which is first punched and then sheared into the smaller-size members. This method results in a reduction of material loading and unloading time at the Wiedemann press, in addition to eliminating a layout operation. Large cutouts of various shapes are also often made with a series of coordinated punch operations. A safety interlock prevents accidental tripping of the press until the upper and lower turrets are in proper alignment.

Idler Pulleys Machined in Special Line

Idler pulleys, a major product of the division, are fabricated, assembled, and painted on a special production line. They are made in 2 3/4-, 4-, 5-, 6-, and 7-inch diameters, and in lengths that vary from 5 1/2 to 81 inches.

The pulleys consist of steel tubing with two welded, pressed steel heads in which are pressed either roller or ball bearings with their respective

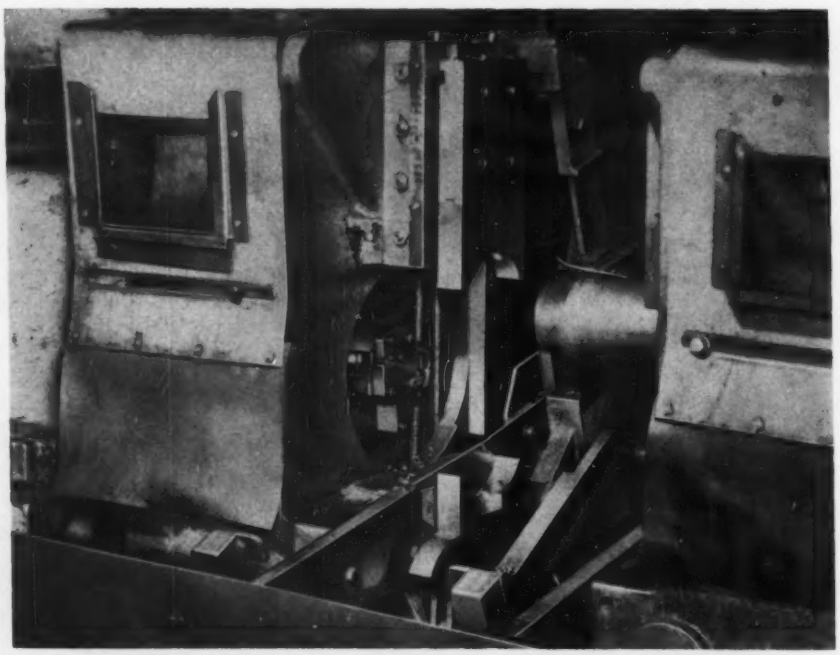


Fig. 3. (Above) Idler pulleys for conveyor belts are bored and turned on both ends in this two-spindle machine. Throw-away carbide inserts are used in the tool-heads. Part loading and machine cycle are automatic.
Fig. 4. (Right) Here, heads are automatically welded on both ends of conveyor idler pulleys. Dual heads for submerged-arc welding are employed. Time required for the operation is one-half minute.

seals. The pulley tubes are bored and turned on both ends simultaneously with special cutter-heads in the special automatic machine seen in Fig. 3. The operation leaves thin-wall shoulders 0.020 inch thick, which are later crimped over to hold the heads in place for subsequent automatic welding operations.

The boring machine has two opposed spindles equipped with special tool-heads having preset indexing type throw-away carbide inserts. Both ends of the tube are machined simultaneously at a cutting speed of 600 sfpm. In the illustration, a 5-inch diameter by 13-inch long pulley is seen on the magazine chute about to be automatically positioned and clamped for machining. About 300 cuts per edge are obtained and eight sides can be indexed per insert. Thus, 2400 cuts are made by each of the Vascoloy-Ramet Grade VR-75 inserts used.

Previously, brazed carbide tools were used. These required fifteen minutes each to change and reset to size, and another fifteen minutes to grind. Eight tool changes were generally made per shift at a cost of two man-hours. In comparison, the carbide inserts can be indexed in only two minutes.

Welding Also Automated

After being mounted in the ends of the idler pulley, the heads are welded in place by the automatic welding equipment seen in Fig. 4. This machine produces a circumferential weld on both ends simultaneously in one-half minute. Lincoln Electric submerged-arc welding heads operating at 325 to 410 amperes and 25 to 32 volts are employed. Welding is done at 75 to 110 ipm, depending on the diameter of the pulley. The parts are fed to the machine through a magazine chute and ejected automatically. About 1000 average-size pulleys can be welded on each shift in this machine.

Another novel change in manufacturing techniques at the plant is the substitution of a punching for a drilling operation. Hollow pulley shafts, made of 3/4-inch diameter steel tubing having a wall thickness of 0.149 inch, require a 3/16-inch diameter grease hole. These are now punched at a rate of 250 pieces per hour with a special die in the press shown in Fig. 5. Two parts are punched at a time, and deburring, formerly required after the drilling operation, has been eliminated by use of this method.

Fig. 5. Instead of drilling grease holes in these hollow shafts for conveyor roller pulleys, they are now punched in this press two at a time. Use of the method has eliminated a deburring operation.

Age-old art

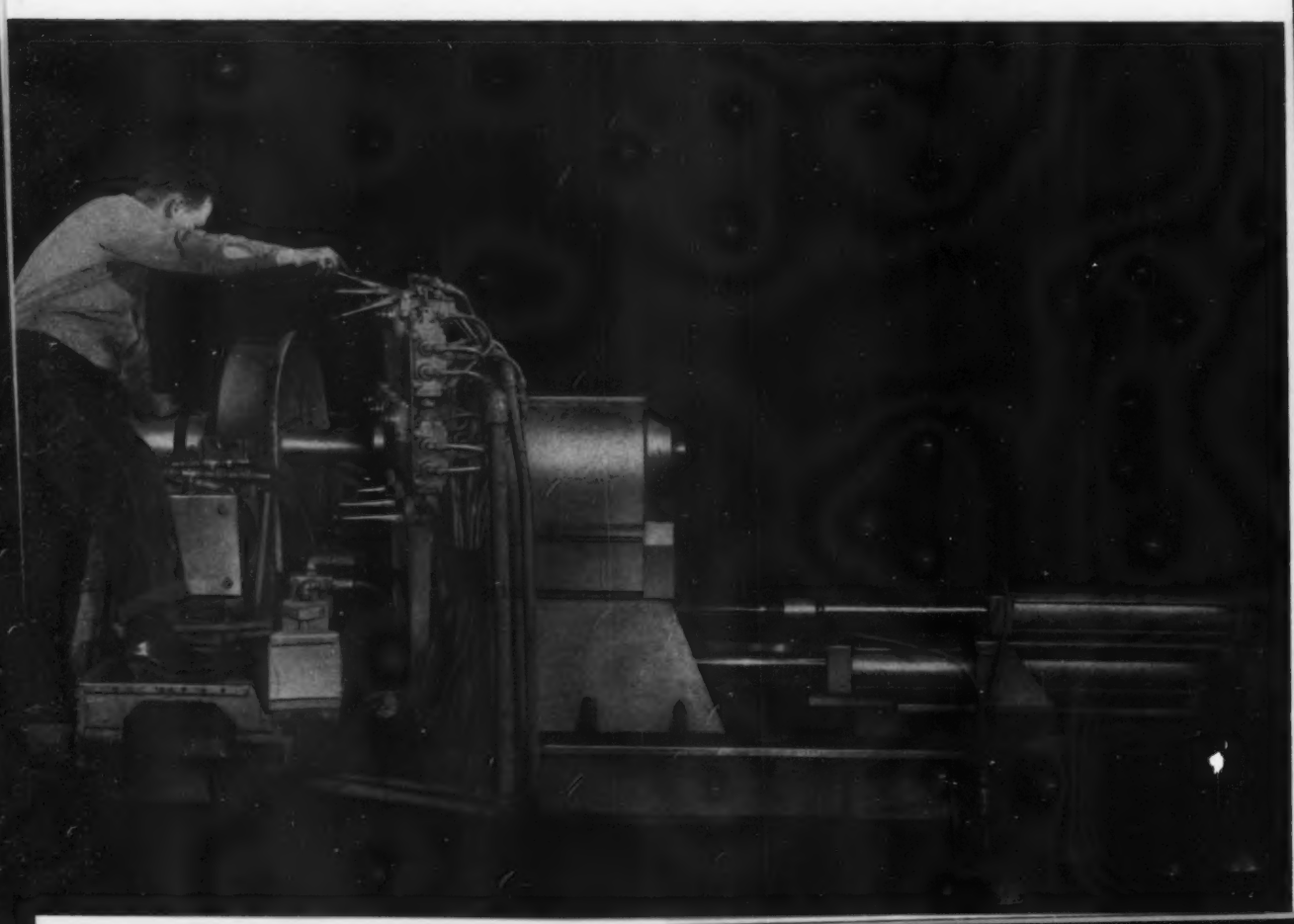
—helps build

RAYMOND H. SPIOTTA
Associate Editor

FOR OVER THIRTY YEARS the energies of C. W. Torngren Co., Inc., have been devoted to production through spinning. In its shops in Somerville, Mass., one can see an array of equipment ranging from the smaller lathes on which the metal is hand-stroked to shape, up to a large spinning stand accommodating 16-foot diameter blanks and using portable pneumatic cylinders to power the forming rolls. But outstanding among the equipment are the machines used in the company's exclusive Mecatorn process.

Significant in the field is the company's development of the Mecatorn process. The hydraulic-pneumatic machines designed for this work are similar to the various commercially available shear-spinning machines, with certain exceptions.

One of these differences is that the Mecatorn machines provide three-axis tool movement. In



New England firm dedicated to spinning as a metal-forming medium is using this often-overlooked craft to shape parts for today's nuclear-powered submarines

nuclear submarines

addition, although the tools are completely power-operated, their movement is under the direct control of the operator at all times. Tool pressure and rate of travel are under continuous control through a bank of hand valves on the operator's console. Optimum conditions are established with the first piece, then repeated for each succeeding piece.

Another difference is that the process does not reduce blank thickness to any substantial degree. This leads to its greatest advantage. The Mecatorn machine can produce the same configurations as are possible with hand spinning—sharp changes in direction, re-entrance curves, and other difficult-to-form sections.

Two sizes of these machines are in use. The No. 1 model is the smaller and will accept blanks up to 4 feet in diameter. Maximum thickness in stainless steel is 3/8 inch; in aluminum, 3/4 inch.

For light work, air under a maximum pressure of 200 psi is fed to a 10-inch diameter cylinder that powers the spinning roll. Line contact between the roll and the work surface reaches a force of 58,000 pounds. If heavier work is to be done, air pressure is cut off and hydraulic pressure is used at 1000 psi to yield a line contact force of 85,000 pounds.

The No. 2 machine (heading illustration) is the larger of the two, but functions in the same way as the smaller model. Power for the spinning roll is provided either pneumatically (for light work) or hydraulically (for heavy work). Using hydraulic pressure, a line contact force upwards of 200,000 pounds can be obtained. Also, the tailstock can apply up to 28,000 pounds of force. This machine will handle blanks up to 8 feet in diameter. Maximum thickness that can be formed in stainless steel is 5/8 inch; in aluminum, 1 1/2 inches.

Two tool carriers are mounted on the same carriage, one in front of the machine and one behind. By bringing both rolls into contact with the work during heavy-gage spinning, pressure will be equalized on both sides of the mandrel and headstock spindle.

Spinning, although one of the earliest means of metal-forming, is used to produce parts for modern submarines. One example is the double-

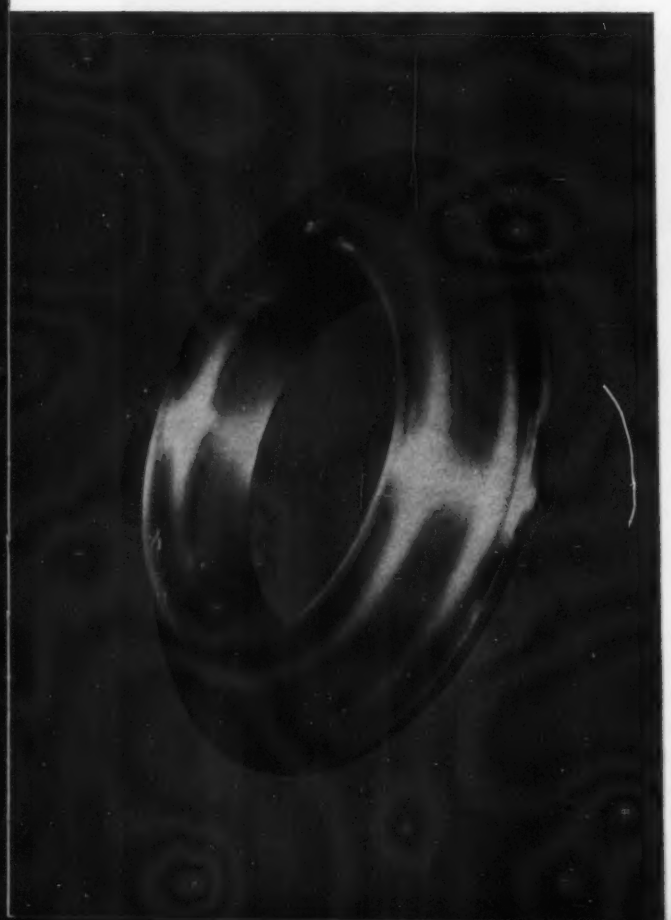


Fig. 1. Bulkhead penetrant seal ring for power plant in nuclear submarine. This double-reversed form is power-spun from 3/16-inch thick Monel.

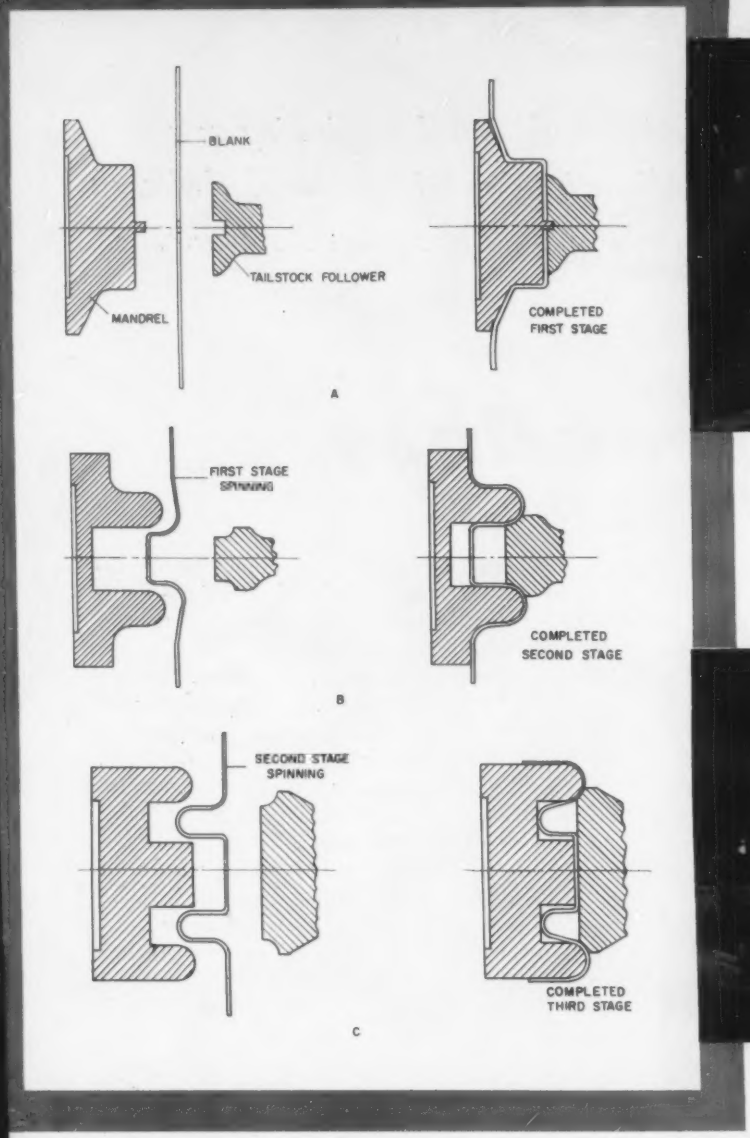


Fig. 2. Three stages are required to spin the bulkhead seal (Fig. 1). The part is reversed before being nested in each succeeding mandrel.

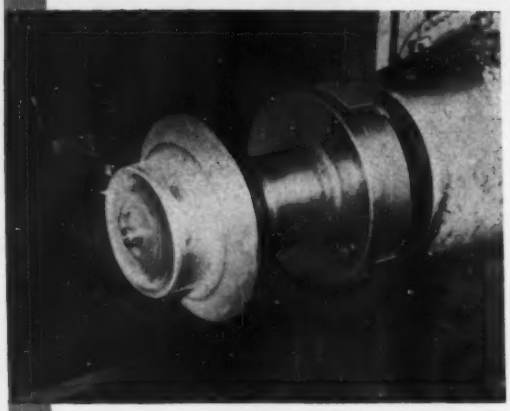


Fig. 3 (Above) Mandrel for first-stage breakdown is mounted on No. 1 Mecatorn machine. Forming roll can be seen at left.

Fig. 4. (Below) Setup for the third, and final, stage (work-piece not shown). One roll completes reverse forming of outer flange.

reversed form in Fig. 1, which is a bulkhead penetrant seal ring for a nuclear submarine power plant (made for Westinghouse Electric Corporation, Plant Apparatus Division). It starts off as an 18-inch blank of cold-rolled and annealed Monel (QQ-N-281A), 3/16 inch thick.

When the project was begun, the first four attempts ended in failure due to defoliation of the material. It became necessary to search out a Monel of spinning quality before the job could get under way.

Three spinning stages are used to arrive at the final configuration. Each of these stages is illustrated in Fig. 2. All mandrels are made from blocks of mild steel, carburized and sandblasted.

In Fig. 3, the first-stage mandrel, or chuck, can be seen in place on a No. 1 Mecatorn machine. For this first, or preforming, stage (Fig. 2, A) the blank is pierced to locate on a 3/4-inch diameter mandrel pin. A tailstock-mounted follower is then brought into contact with the blank to hold it against the mandrel and prevent slippage. One tool is used during this breakdown operation while the blank is rotated at 300 rpm. Although the purpose of this stage is to prepare the work for the next, a portion of the blank is brought to final contour.

In the second stage (Fig. 2, B) the work is reversed and the small hub is inserted in the recessed mandrel. (Prior to this, the end wall of the hub is removed.) Before anything else is done, a portion of the work already spun is reworked

to assure a proper fit with the mandrel. Only then is the tailstock follower locked against the part.

Two diametrically opposed tools are used for the second-stage reverse spinning because of the heavy pressures involved and the need to prevent excess strain from being applied to the headstock spindle. If need be, the tools can be positioned individually to avoid "sombreroing" of the rim of the blank. At the completion of this stage about 40 per cent more of the final configuration is achieved.

Third-stage setup (Fig. 2, C) involves another reversal of the partially finished blank. This time, an internal boss on the mandrel, Fig. 4, enters the rear of the work-piece hub while the U-shaped bend nests in the face of the mandrel. As in the previous stage, positive contact between tool and work is assured by reworking a portion of the bulkhead seal before the tailstock follower is advanced. Reverse spinning in this final step is done by a single roll which completes the contour.

Throughout the spinning operations a sulphur-free oil is used for lubrication between the roll and the work-surface. Work hardening, a by-product of spinning, is relieved by bright annealing (1800 degrees F.) in a sulphur-free atmosphere after each stage. At the discretion of the operator, annealing may also be done within any stage. Quenching is in cold water to which denatured alcohol has been added. The alcohol helps to clean the parts and also brighten them, causing a faint copper tinge. A slight oxide film remains, but this aids in spinning due to its lubricating properties.

In a last step the bulkhead seal is mounted on a lathe where a skimming cut is taken both inside and out. It is then polished with 180-grit emery cloth (dry).

While still on the lathe, Fig. 5, an ultrasonic check is made with a Vidigage to determine part thickness. Checks are made at 144 points—twelve points along the cross section at twelve radial locations around the clock. The operator applies glycerin to the area being inspected, then contacts each check point individually. Thickness must not vary more than 0.003 inch per 1/8 inch to be sure that there are no points of possible stress concentration.

Fig. 5. While mounted on a lathe, thickness is checked ultrasonically at 144 points (twelve in each of twelve radial locations) around the spinning. It must not vary more than 0.003 inch per 1/8 inch.

Connecting-rods precision-bored by preset multiple-insert tool

With chip loads reduced by a three-bladed boring cutter, Pontiac combines boring and reaming in one operation and finishes crankpin holes free from bellmouth, out-of-roundness, and taper. Productivity and speed are raised, costs and time are down

LAURENCE W. COLLINS, Jr.
Associate Editor

THE ENGINES for Pontiac's regular and Tempest lines of 1961 automobiles are likely to run quieter, better, and longer because of a novel development in tooling for connecting-rod crankpin bores. This boring machine tooling, developed in an attempt to increase machine productivity, has accomplished its objective by permitting greater spindle speed; and it saves tool-change down time through the feature of a quick-change head that permits presetting.

Relatively unchanged, the standard method of boring connecting-rods is in an Ex-Cell-O connecting-rod boring machine, Fig. 1. This unit has three pairs of horizontal spindles. Three connecting-rods are held in outboard fixtures on the end of the machine, with all six spindles advancing at once to bore the three small wrist-pin holes and the three larger 2.373-inch crankpin holes. The caps are necessarily bolted in place on the rods for the operation. The large crankpin bores have been the source of annoyance because the holes, as bored, showed a tendency to dimensional inconsistencies, such as out-of-roundness, bellmouth, taper, out-of-squareness, oversize, and undersize. The holes had to be reamed as a separate operation. The boring tools were standard, with single-point tungsten-carbide bits removing about a 0.015-inch depth of stock. Tolerance for the bores is plus or minus 0.002 inch.

The fixturing violates what is considered one of machining's oldest laws, which states that it is not good practice to bore against the clamps

Fig. 1. Tool setter adjusts precision boring head to take up carbide wear. Wrist-pin holes are bored by the three top cutters, the crankpin holes by the three lower heads.

for any work-piece, Fig. 2. However, Pontiac, to improve accessibility in loading the fixtures, has been successfully boring against the clamps, a method that has consistently produced results at least no worse than those attainable by so-called good practices.

Through investigation and experiments, Pontiac's manufacturing engineers finally opened the way to greater speeds and feeds, and in so doing they isolated the source of inaccuracies in boring the crankpin holes. Reduced chip loading of

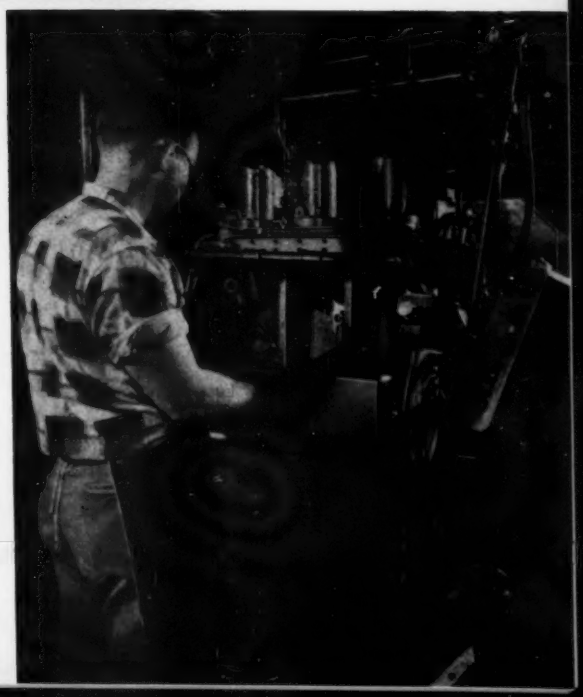


Fig. 2. The operator loads the clamps of the Ex-Cell-O connecting-rod boring machine with three forgings.

the cutter was the solution to the problem. The job was tried experimentally with double-blade cutters. Results showed so much promise that a boring head with three cutters was tried. Thus the chip load on each blade could be reduced to the optimum and still permit spindle feed and speed to be increased. Consequently cycle time could also be reduced. With the old single-point boring setup, production of the machine was about 100 pieces per hour, with reaming required as a follow-up. The new three-bladed precision boring cutters, Fig. 4, permit boosting speed to 150 pieces per hour. Surface finish meets specifications.

Productivity Increased by Quick-Change Preset Tooling

Part of the increased productivity is the result of the use of the preset-tooling principle, which permits the cutter-head to be replaced in a few minutes' time. The standard two-piece boring head was replaced with a quick-change adapter for the three-blade cutter-head, both built by the Valenite Metals Division of Valeron Corporation, Royal Oak, Mich.

Design of the Valenite Kamset cutter, Fig. 4, is unusual. With its three blades it resembles a milling cutter; however, blade relationship and geometry bear a strong resemblance to those of a reamer. For example, the edges of the circular cutter inserts are 5 degrees "above" center (see Fig. 3). The inserts, furthermore are held in cartridges which bear a strong resemblance to single-point lathe tool-holders in miniature. The circular inserts are Cole carbide 1/2-inch diameter insert bits with a 5-degree hook ground in the top and bottom faces to offset the 5-degree negative rake of the tool. The life of an insert is approximately fifteen indexes for each side, or a total of thirty for the insert. About 500 connecting-rods can be bored before it becomes necessary to index the cutter inserts.

Adjusting the Boring Head

The quick-change boring head holds three tool cartridges. Construction is such that by turning a micrometer cam-adjusting screw in the face of the body all three bits move outward radially at the same rate, Fig. 4. Thus a few degrees' turn of this screw compensates for tool wear at a cost of only a few seconds' interruption in production of the connecting-rods.

When new cartridges are to be set, the body is removed (by loosening one set-screw) and

Fig. 3. The precision boring head is built like a milling cutter but has the design of a reamer insofar as the orientation of the insert is concerned. Both the tool cartridges and the cutter bodies are interchangeable. The drive-pin is loosened for quick tool-head changes.

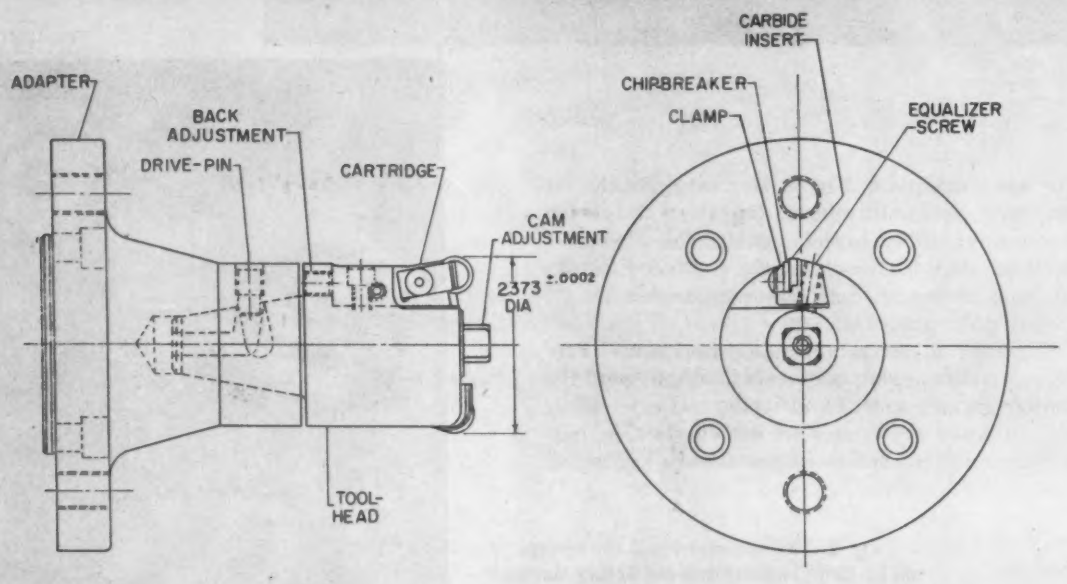


Fig. 4. The circular carbide cutters are each clamped in a cartridge-holder gripped by the cutter body. Simultaneous adjustment of all three bits is made by the square center screw.

Fig. 5. Setting of the cartridges is done on a fixture (background) near the machine. Precision presetting of the bits is not needed because head holds cutting edges to 0.0002-inch tolerance.

placed on a presetting gage, Fig. 5, at an adjoining work-bench.

When inserts are indexed to bring a new cutting edge into play, a single set-screw is loosened with the head on the machine to assure positive alignment. The cam-adjusting screw is first returned to zero position; the insert hold-down screws are backed off so that the bits can be indexed. After the clamp screws are tightened, each edge can be separately gaged and clamped and the head is ready to go to work again. Provision is also made for adjusting the cartridges individually, if necessary. The cartridges are interchangeable and are available as stock items. In addition, the cutter bodies are also interchangeable.

The single-point solid-carbide tool bits used at the previous feeds and speeds will last only a few pieces at the new machining rates because of the poor chip-load factor. The new multiple-bit cutters, at optimum chip load, hold dimensional tolerances, and feed and produce a satisfactory surface finish with increased productivity and at lowered tool cost.

Automatic leveling device applied to jig transit

AN ELECTRONIC DEVICE which can indicate a level position at a remote location or be arranged in combination with a servomechanism to provide automatic leveling (or angular positioning) has been developed by Convair, San Diego, Calif. Designed specifically for use on machine tools, fixtures, and measuring instruments, the test model was successfully set up to automatically relevel a jig transit (heading illustration) as it was moved from position to position. Accuracy and repeatability of the experimental unit proved to be 15 seconds per foot (one-half of a graduation on the spirit-level vial used).

Operation of the device, Fig. 1, is based on the manner in which light waves pass through the glass tube of a spirit level. When a beam of light traverses the liquid-filled portion of the tube somewhere above the center of its cross section, the rays are refracted downward and emerge from the tube as shown by the solid lines in Fig. 2. If, instead, the beam is passed through the bubble of air above the liquid in the spirit level, the emerging light will then more nearly follow the straight, horizontal path shown dotted in the same illustration.

Thus, should a spirit level be placed in a level

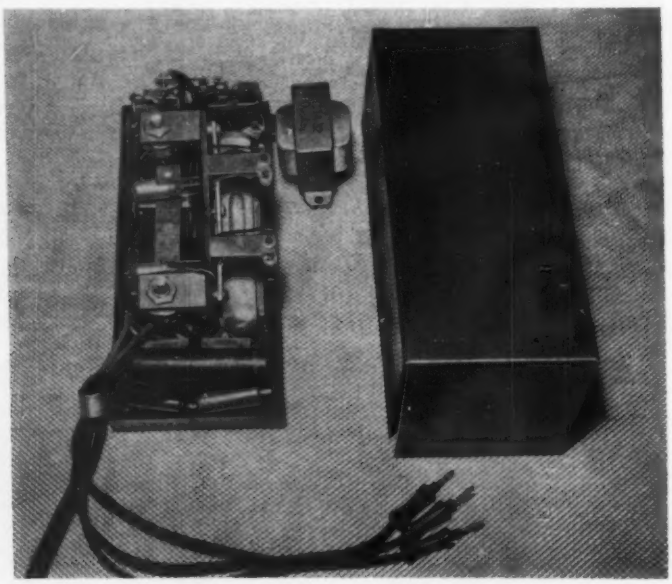


Fig. 1. Device for sensing a level position which can be used in combination with a servomechanism to provide automatic leveling.

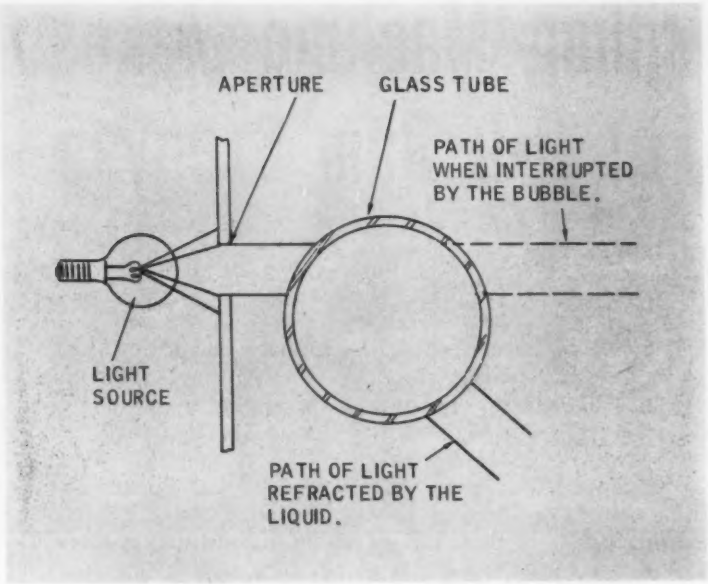


Fig. 2. Optical principle on which the level-position sensing device is based.

position and two beams of light, one at either end of the air bubble, be projected through the tube, any subsequent out-of-level repositioning of the tube would cause a change in the direction of one of the emerging beams as it is interrupted by the bubble. Electrical servo information can be obtained simply by arranging photocells to intercept the emerging beams.

Although any number of circuits could be employed to make use of the signals from the photoelectric tubes, the circuit in the experimental unit was designed for good operation and ease of construction. Since the photocells selected were extremely sensitive and had high power-dissipation ability, a tubeless control circuit was made possible. The device, being capable of switching two 120-volt lines on or off, can be used to operate any alarm, recording, or light-indicating system.

The experimental unit was connected to a 4-rpm, reversing gear-head motor, and the combination was mounted on the hinged base of the "electronic positioner" seen in Fig. 3. The output of the motor is used to relevel the hinged base, with feedback servo information being provided by the leveling device. In one practical application, a jig transit, mounted on the base of the positioner in the manner shown in the heading illustration and close up in Fig. 3, was automatically releveled as it was moved from point to point. Generally, in order to re-establish the level of this instrument, one man sights through an alignment scope and directs another adjusting the jig transit. The basic electronic level-sensing device may also be used in conjunction with tooling equipment wherever a remote means of indicating a level position is required.

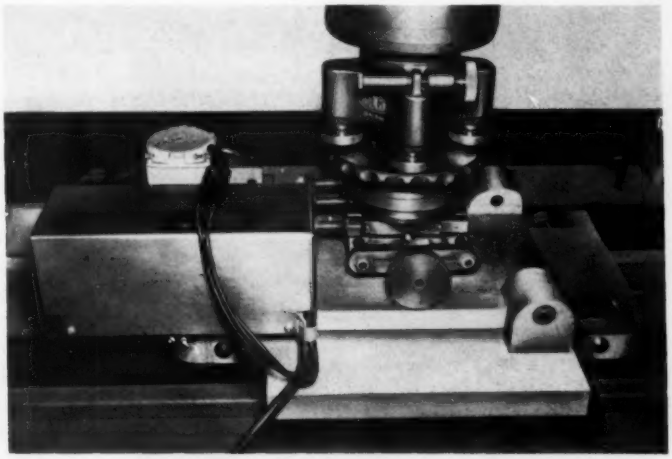


Fig. 3. This automatic positioner, an application of the device seen in Fig. 1, is set up for releveling a jig transit. Mechanical feedback is obtained by mounting both the sensing unit and the transit on servo-controlled hinged plates.

Converted Milling Machine Makes Short Work of 3-D Cam Grooves

J. E. LAIBACH, Chief Tool Engineer
Aero Supply Mfg. Co., Inc., Corry, Pa.

AN UNUSUAL CAM TYPE SHAFT for controlling the drag-chute release in a jet aircraft is being produced by three-dimensional tracer milling at the Aero Supply Mfg. Co., Inc., Corry, Pa. Designed by Aero engineers, the shaft is necessarily complex in order to force proper sequence of operation, to prevent malfunctioning, and to provide the pilot with a reassuring positive "feel" in the form of a controlled pull and definite stop positions. All this is intended to keep operation of the release from being a matter of distraction during landing, when the pilot has much to occupy his attention.

Control is achieved by two screws fixed in stationary frames. Hardened and ground points of these screws ride in various shaft grooves. The grooves, which can be seen from a number of positions in Fig. 1, determine where and how the shaft can be moved—whether it can be pulled, turned, or pushed. Detents in the bottom of the grooves enable the pilot to feel when he has reached certain positions in the sequence of operation without the need for visual checking.

Smooth, controlled-pull operation requires precision in location, size, and finish of the grooves. Specifications call for holding the 0.125-inch groove diameter within plus 0.000 minus 0.006 inch. Spherical radii are held to 0.062 inch, plus

Fig. 1. (Right) A group of drag-chute release shafts. The one at the right has been rough-ground preparatory to profile milling. Remaining five completed shafts are identical, but have been turned to various positions to reveal configurations of cam grooves.

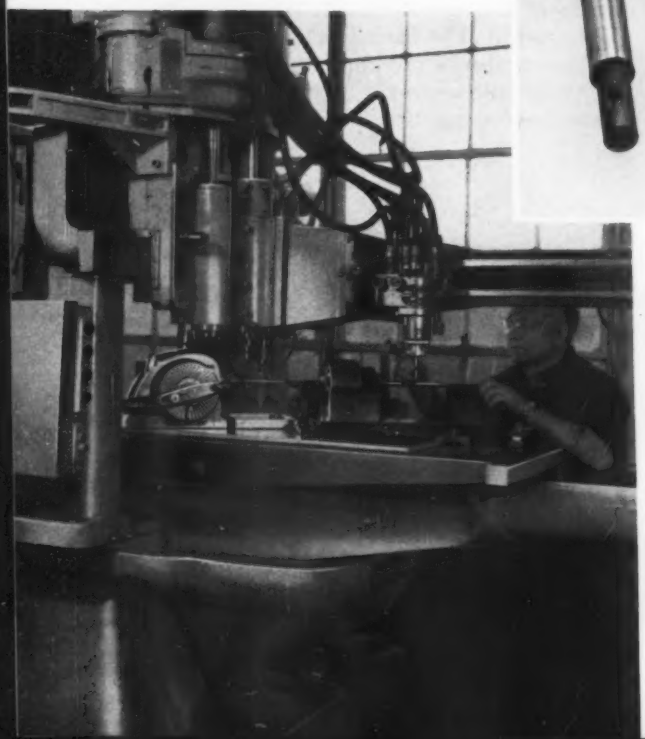


Fig. 2. (Below) Cam grooves are cut on this three-dimensional profiler, which is a conversion of a standard vertical milling machine. A sensitive tracing head was added and the necessary modifications were made to provide proper hydraulic response.

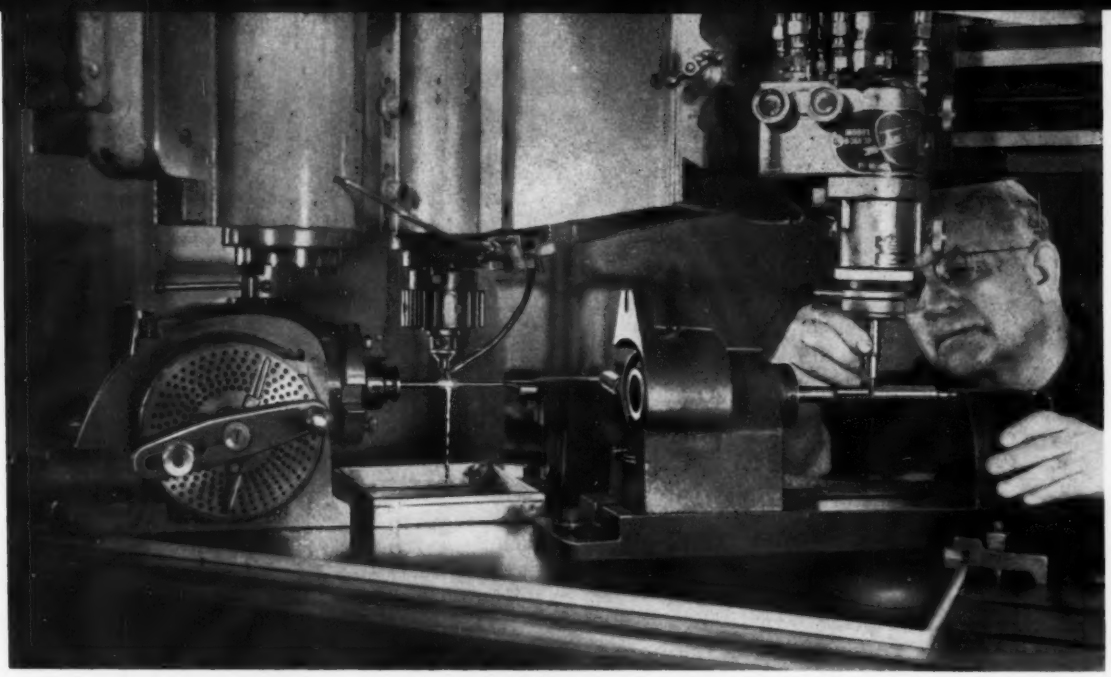


Fig. 3. Work-piece (left) is held in a dividing head while the oversize master (right) is supported by an indexing fixture. Although originally mounted parallel to the edge of the table, both fixtures have been set at the angle shown to combat the discovered tendency of the tool to wander slightly from a straight-line path.

0.000 minus 0.003 inch, while groove depth is 0.062 inch, plus 0.005 minus 0.000 inch. Grooves are parallel with each other and with the shaft center line within 0.003 inch TIR. Surface finish of the milled areas must be no greater than 63 micro-inches.

Outside quotations for manufacturing these shafts were gathered, but after considerable deliberation, it was decided to keep the job within the plant. At first the operations were done on a vertical milling machine using a No. 3 dividing head. Production time with this setup was an unsatisfactory two hours per piece.

This time was cut by almost one-quarter when the job was shifted to the newly installed Hydro-Version machine (Arrow Engineering Co., Largo, Fla.) shown in Fig. 2. Production rate was increased to 1.9 pieces per hour, finish was improved, and rejects were eliminated. The machine is basically a Pratt & Whitney vertical miller that has been modified to accept a True-Trace head and that has undergone the necessary conversion to enable it to perform hydraulically controlled, three-dimensional tracer machining.

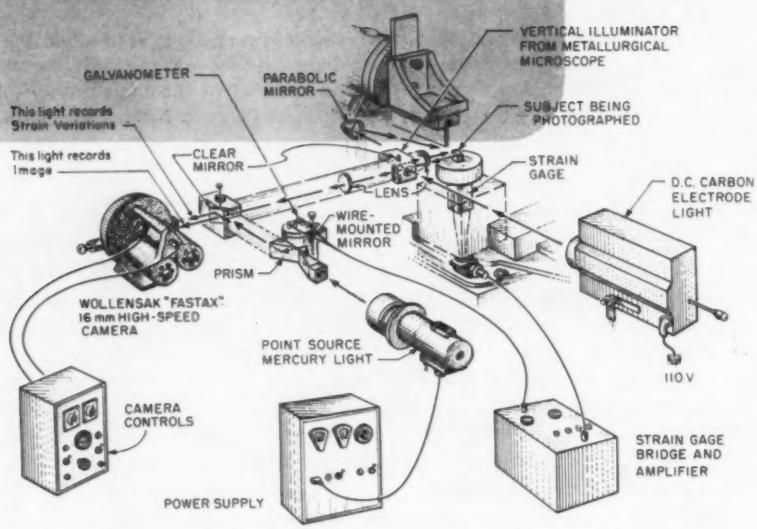
Shafts are step-turned on a turret lathe from Type 440 stainless-steel bar stock. Then, also on a turret lathe, both ends are center-drilled, holding concentricity with the main diameter within 0.001 inch. The main, or body, diameter is rough-ground to 0.380 inch, and a notch (lower end, third shaft from the left, Fig. 1) is milled in one end of it for locating purposes. A hole is drilled in line with this notch and then countersunk.

The work-piece is now ready for the three-dimensional profiler (Fig. 2) where the grooves and detents are machined with a 1/8-inch diameter end mill. A No. 3 dividing head supports the shaft (left, Fig. 3) while the master, which is 50 per cent oversize, is held in an indexing head (right). When the first few pieces were run the heads were positioned so that the work-piece and master were parallel with the direction of the table travel. But it was found that this allowed a slight, but unacceptable, weaving of the tool down the length of the cam grooves. To overcome this the work-piece and master were shifted 30 degrees to the positions shown. This maintains the tool pressure against the far side of the groove as the end mill proceeds along the cut, keeping it steady and within limits.

Hand feed is used because the profiler does not have a sufficiently low hydraulic feed rate. The depth of cut is 0.010 inch, so that seven passes are required to complete each groove.

Following the profiling operation a second hole is drilled; then holes, slots, and detents are deburred and sharp edges of the grooves and detents are broken. The shafts are next induction-hardened from 46 to 55 Rockwell C, and stress-relieved. Straightening is done, if necessary, before the diameters are finish-ground between centers. The shafts are once again stress-relieved, after which vapor-blast cleaning and passivation of the surface complete the job.

Study reveals mechanics of chip formation



THERE ARE MANY THEORIES associated with the cutting of metal. Some investigators have likened the process to a successive shearing action. One reported that in addition to shear, other considerations involved are grain compression, the slip of cleavage planes, rotation of slip planes, and twining. Another has visualized the chip formation as being akin to the flow of viscous material over the tool face, similar in nature to a squeezing or upsetting. A recent theory discards the idea of a shear plane and states that deformation during metal-cutting is continuous.

In an effort to secure more information on the process, a technique whereby basic data on metal-cutting may be rapidly recorded, retrieved, and analyzed was developed. The equipment and setup employed are shown in the heading illustration and described in detail on the opposite page. With this arrangement, high-speed photographs were taken of polished and etched steel being cut at realistic speeds, and at the same time a discrete measure of tool forces was recorded. A magnification of 5 was used in photographing the subject, and when the developed film was projected on a screen, a magni-

To better establish the fundamentals of metal-cutting, an investigation has been made using high-speed motion pictures taken at approximately 4000 frames per second and a 5× magnification. A moving spot of light indicating the tool force was recorded with the main image. This is an abstract of a paper presented at a recent meeting of the American Society of Mechanical Engineers by S. N. Agrawal, industrial engineer for the Ingersoll Milling Machine Co., Rockford, Ill.; R. D. Harris, professor at the University of California, Los Angeles Calif.; and B. H. Amstead, assistant dean of the College of Engineering, the University of Texas, Austin, Tex.

Arrangement of the Equipment

In order to minimize the difficulties encountered in photographing chip formations at high speeds, a shaper was converted into a "planer," as shown in the heading illustration. This was done by inverting both the tool and the work, the work being secured in a fixture on the ram and the tool being rigidly held in the vise on the shaper bed. The camera was retained in a fixed position on a table attached to the bed and was focused on the tool tip.

A 7/16-inch square Rex AAA high-speed-steel cutting tool manufactured by the Crucible Steel Company of America was used in all tests. The back-rake angle varied from 15 to 30 degrees and the relief angle was 8 degrees. A strain gage, fitted to the tool-holder, indicated tool forces and the resulting vibration. Strain-gage response was amplified by means of a bridge and an amplifier having a maximum amplification of 15,000. The amplified signal was made the input to a mirror type galvanometer which reflected a beam of light delivered from a light source to a clear mirror. This mirror, in turn, reflected the beam to the film in accordance with and proportional to the strain on the tool. The response rate of the system was tested at camera speeds up to 7000 cycles per second.

A high-pressure, point-source, air-cooled mercury-arc lamp rated at 140,000 candles per square centimeter was used to supply a beam of light for recording tool force. In order to calibrate the magnitude of the tool force traced on the film by the light beam, a known force was applied to the tool and the corresponding deflection of the beam was observed in the reflex telescopic view finder of the camera.

The "Fastax" high-speed motion-picture camera employed has a lens section designed to magnify the image five times. This magnification is relatively large when compared to that normally employed to photograph nonluminous subjects. Most of the studies to date have been accomplished with maximum camera speeds of from 3000 to 7000 frames per second. A 110-volt, direct-current carbon-electrode lamp provided light for photographing the image, and a vertical illuminator from a metallographic microscope was incorporated into the objective lens attachment to direct light on the subject. Additional light was focused on the subject by a parabolic-shaped mirror precisely located to collect rays which "spilled" around the lens section.

A micro switch attached to the shaper ram insured the starting of the camera at the proper time. Also, a neon timing light, flashing 120 times per second, exposed the edge of the film; thus, the camera speed could be determined from the number of frames between exposed areas.

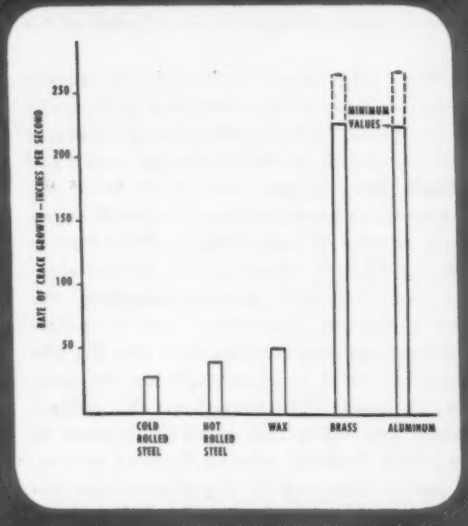


Fig. 1. (Top) High-speed photographs showing the cutting of beeswax. Resulting deformation in grid of scribed lines helps illustrate the stress pattern that developed.

Fig. 2. (Bottom) Relative rate of the growth of cracks across chips made brittle by strain hardening due to cutting action.

fication of approximately 200 was possible. At this magnification some grain structure was visible, and deformation details could be viewed.

In the study, some of the data were gathered without recording the tool forces. One of the first materials cut was beeswax having a specific gravity of 0.960 and a melting temperature of 154 degrees F. Many of the phenomena studied in subsequent tests on mild steel, brass, and aluminum had certain parallels to those experienced in cutting this wax. A 3/8-inch wide specimen having grid lines scribed 0.050 inch apart was used. The cutting speed was approximately 50 fpm, the depth of cut was 0.10 inch, and the tool employed had an 8-degree relief angle and a 20-degree back-rake angle.

In Fig. 1, a film strip taken at 7200 frames per second illustrates the stress pattern that developed during machining of the beeswax specimen. Deformation began well ahead of the tool point and was apparent not only in the body of the chip but extended below the machined surface. The wax deformed into the chip in a parabolic manner, the horizontally scribed lines being carried off with the chip. The vertical lines were compressed in the chip but remained approximately parallel. Near the end of the cut, cracks began to appear in the chip next to the tool face. These cracks were approximately 1/20 inch apart and became wider and deeper as the cutting speed of the shaper reached the maximum. The cracks extended in a direction roughly perpendicular to the tool face and were severe enough to extend two-thirds across the width of the chip. The appearance of these cracks was unexpected inasmuch as the wax was thought to be ductile enough to take the strain without fracture.

One investigator has observed that there are two types of cracks formed during metal-cutting, both the result of maximum normal stress. They are the spontaneous cracks that form rapidly in a perfectly brittle material and the relatively slow-growing cracks that attend plastic deformation.

Since the cracks were more prominent at the higher cutting speeds in the wax, it might be reasoned that the strain rate was more severe because of the greater speed. It is generally accepted that most materials are more brittle at high strain rates.

The relative rate at which brittle cracks were propagated across chips of various materials is shown in Fig. 2. Although the data is limited, its general validity in this case may be attested. Rate of crack growth was determined by counting the number of frames between the beginning and the end of the process, the speed of the film being known. There was very little variance in the observed data due to tool modifications or moderate changes in cutting speeds.

This technique may be refined to obtain very accurate values of crack growth in various materials. Cracks always appear to grow from the face of the tool toward the free side of the chip. Since the material next to the tool face was most severely strain-hardened, growth would be expected to begin there. In most cases, the crack did not go completely across the chip as less strain hardening occurs in the outer portion.

In all the materials studied, cracks probably began, in part, from smaller cracks or nonhomogeneities in the metal. This partially explains why cold-rolled steel showed more frequent, but less severe, cracks than hot-rolled steel. Cold-rolled steel is strain-hardened in the rolling process, grain structure has been more refined, and the inclusions and small nonhomogeneities more widely distributed.

A photograph made from a film strip taken at 6500 frames per second of cold-rolled 1018 steel being cut at 75 fpm and a 0.020-inch feed, is seen in Fig. 3. The back-rake angle of the tool is 20 degrees and the relief angle 8 degrees. The photograph shows the beginning of a built-up edge and crack formations extending from the tool face toward the center of the chip. The angle between the horizontal and a line drawn between the tool point and the point where the chip and free surface of the work-piece intersect is 22 degrees. This is referred to as the shear angle. There is no straight line of demarcation between the two points, however, and very high magnification revealed no observable deformation by slip.

Two photographs, both made while machining A755T hot-rolled steel at 75 fpm using a 0.020-inch feed, are shown in Figs. 4 and 5. The tool had a back-rake angle of 20 degrees and a relief angle of 8 degrees. Both pictures were taken at 6000 frames per second.

Although the shear angles of the cutting action in Figs. 4 and 5 are both 22 degrees, the angle varied from approximately 20 to 30 degrees. During the cut a built-up edge (Fig. 5) would begin forming slowly and suddenly grow very large, at times being as much as one-third of the chip thickness. The build-up never remained stationary but instead traveled along the front of the tool. This motion occurred, however, at a much slower rate than that of the chip in passing the built-up edge. As the size of the built-up edge increased, so did the rate at which it passed off until both the build-up and chip had the same velocity. In the case of hot-rolled steel, large cracks began to occur in the face of the chip when the build-up passed off. Several cracks would appear in uniform succession at about 1/20 inch apart, growing larger at a rate of approximately 40 ips. As soon as the build-up developed, however, the crack formation would cease. There seemed no set pattern as to how long build-up lasted or how often it occurred.

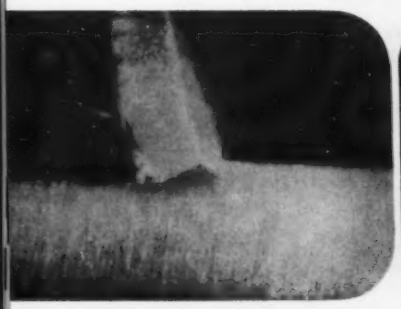


Fig. 3. Photograph taken at 6500 frames per second shows cold-rolled steel being cut at 75 fpm. Cracks have formed in the chip.

Fig. 4. Hot-rolled steel being machined at 75 fpm. Shear angles varied from approximately 20 to 30 degrees.

Fig. 5. Another photograph of the operation shown in Fig. 4. A built-up edge is seen being formed in front of the tool.

The formation of a built-up edge appeared to be caused by the sticking or welding of some of the viscous particles to the tool. This built-up edge in turn became the cutting edge. As more of the viscous material stuck to previously adhered particles, instability resulted. When the frictional resistance between successive layers of viscous particles became greater than the frictional resistance between the built-up edge and the tool, the built-up edge would slough off. Since the built-up edge became the primary cutting edge during the periods it was in front of the tool, the sharpness of the basic tool is quite likely needed only occasionally during a cut in order to set up a well-balanced plastic deformation and the proper compressive conditions.

The consequence of build-up was to increase the effect of shear angle, since the build-up appeared as a rough tool point. A line drawn from the tool point to where the chip turned up did not appear to change because of build-up or

Fig. 6. The deformation seen here in front of and below the tool point occurred during the machining of hot-rolled steel at 92 fpm.

crack formation alone. In the cutting of both hot- and cold-rolled steel, the shear angle was found to vary as much as 10 degrees in a few thousandths inch of cut without apparent reason.

There was no visible indication that chips left the work-piece as a result of successive shearing action. Instead, the work-piece showed deformation ahead of the tool both in the area where chip removal took place as well as in the work-piece below the tool. The effect of compression and deformation could be seen in cases where the detail was recorded on film, Fig. 6. This photograph, obtained with a camera speed of 5000 frames per second, was of type A755T hot-rolled steel being cut at 92 fpm at a depth of 0.020 inch. The tool had a back-rake angle of 16 degrees and a clearance angle of 8 degrees.

Unfortunately, in a technique such as this it has been found difficult to photograph the grain structure clearly during the entire cut, owing to the undulating nature of the lighting, vibration, and focal length. Added refinements are expected to assist in improving the photography to permit more vivid recording of grain deformation and allow greater magnification in reproduction.

Although they are not presented here, photomicrographs taken of the work-piece after machining revealed distortion to a depth of several grain "diameters." The grains were deformed ahead of the tool, and in the direction of the cut.

In machining, there is also some lateral deformation of the work-piece or a bulging out of both the chip and the work-piece because of the intense compression ahead of the tool. The process resembles upsetting. Careful viewing of strips of the high-speed film reveals the material in front of the tool in what seems to be viscous form while flowing up the tool point. One can observe this viscous type flow along the face of the tool as well as in the material making up the chip.

It was reasoned that if a chip were predominantly formed by successive shearing action, the tool forces should vary at a frequency which would be analogous to the rate at which the shearing action took place. Hence a number of tests were made in which the tool forces were recorded on the film along with the image of the chip being formed. Although the tool force varied during the cut, there was no correlation between tool forces and shearing action, so far as could be determined.

A portion of a film strip, Fig. 7, taken at 3000 frames per second, illustrates a piece of cold-rolled 1018 steel being cut at 92 fpm and a depth of 0.010 inch. The tool had a 16-degree back-rake angle and an 8-degree relief angle. The photographs clearly show the cutting tool, work-piece, chip, and beam of light which by its distance (*A*, *B*, *C*, or *D*) from a fixed datum indicates a discrete value of tool force. Although the tool force is seen to vary considerably (from approximately 400 to 200 pounds), there is no indication of shearing action having taken place. The tool forces have been integrated to the extent that they show a reasonable degree of correlation to the power supplied to the machine. As this method is refined, considerable information on cutting-tool vibration characteristics should be

obtainable. The data resulting from tool-force variations have not as yet been usable to accurately calculate which portions of the forces are transient and which are caused by natural vibrations. Punched tape and computer techniques are to be employed to ascertain a better understanding of the data obtained.

In an effort to check the response of the light beam indicating tool force, a work-piece was prepared with vertical 1/16-inch slots cut at various intervals. When the chip was separated from the work-piece, the tool force, in every case, went to a zero value instantly. At the end of a cut, the base material beneath the tool broke off at a downward angle and not in the direction of the shear plane. Although it was observed that the material ahead of the tool point deforms in the direction of the cut, only during the final fracture of the chip away from the work-piece is there noted any sharp demarcation of deformation or stress; only then does tool force go to zero. This technique of recording dual data in concord offers unusual opportunity to uncover the details of tool-force variation.

Initial results of the tests indicate that the cutting action is not predominantly one of shear, but one of continuous deformation. The process is a combination of compression, bending, and viscous flow. To some degree, these processes include slip and twining. Again, these phenomena resemble to some extent the upsetting process. The material in front of the tool is compressed and ultimately fails as it escapes over the tool face in the form of a chip under high frictional resistance. Owing to the intermolecular cohesion in the part being machined, the grains are deformed in the direction in which the tool is moving when the tool force is applied. A free-body diagram of the material ahead of the tool may be likened in some respects to that of a cantilever. There is certainly some resemblance to the cantilever, since the final separation of the chip is in the direction in which a fracture of this type structure should occur. Further, the stress at failure and the deflection of a cantilever are proportional to its tensile strength. This is in agreement with the established concept that machinability varies inversely with tensile strength.

Conclusions

From these tests a satisfactory analysis of metal-cutting, at least for materials such as mild steel, would be somewhat as follows:

First, the grain boundaries of the work-piece are apparently compressed in front of the tool. As a result of this, a slight lateral elongation of the material occurs. Then, under high compression, the grains in front of the tool are bent forward and distorted in the direction of the cut. Under these stresses (both in the direction of, and approximately perpendicular to, the cut) the material fails and escapes over the tool in the form of a chip. Grains in the finished surface of the work-piece are distorted; hence, plastic deformation takes place in both the chip and work-piece. Because of the higher pressures and temperatures developed, the material in contact with the cutting edge is more viscous in nature than the material in the outer part of the chip. Also, the high degree of strain hardening that takes place along the tool face fosters the growth of cracks from this face toward the chip center.

The tool face and the chip flow shown in the high-speed photographs resemble the bow of a ship ploughing through water, and analogies to hydrodynamic flow appear plausible.

Fig. 7. Variation in tool force is indicated by position of light beam on this film strip showing the machining of cold-rolled steel at 92 fpm. Lengths (A), (B), (C), and (D) correlate to discrete values of tool force.

Motor housing sequence combined on four machines

Fig. 1. Field sections are roughed and finished on this pair of Bore-Matics. One operator services both machines.

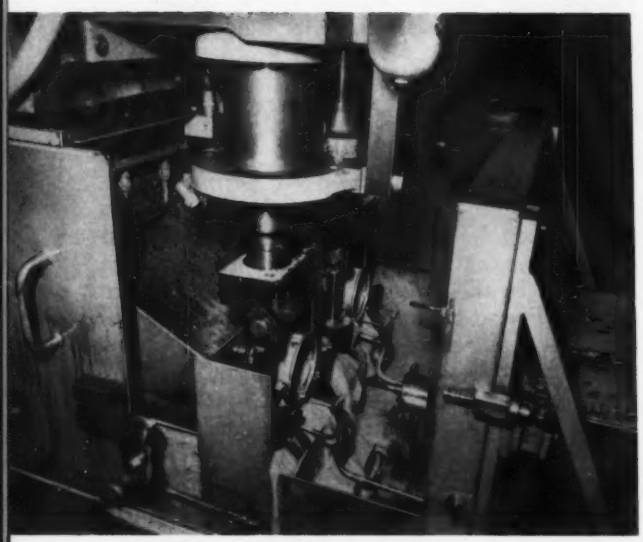


Fig. 2. Close-up view of roughing operations on fan section of motor housing, showing clamping and tooling employed.

REVAMPING a production line that was growing unwieldy has paid off handsomely for a manufacturer of floor-polishing machines. Two years after installing four Heald Model S Bore-Matics to combine some nineteen operations on the polisher's motor housings, the Regina Corporation, Rahway, N. J., reports production up 33 per cent, labor costs down 66 per cent, and—a big plus—the new equipment occupies only half as much space as was needed previously.

One operation, line reaming, has been completely eliminated. What is more, the two sections comprising the housing are now being machined to an accuracy which has made selective assembly no longer necessary. The housings are turned out at a rate of 250 per hour, with scrap and rejected parts held well below 1 per cent.

The machines are arranged in pairs, face to face (Fig. 1); one pair roughs and finishes fan sections, and the other pair roughs and finishes field sections. Only two operators are required, one running each pair. Two others help on a part-time basis for setups and tool maintenance.

Both sections are zinc die castings (SAE alloy 903, ASTM AG40A) held together with three screws. On the fan-section roughing machine (Fig. 2), a 1/2-inch hole for the armature-shaft bearing is reamed, a bronze bushing is pressed in the hole, and a 3/4-inch radius relief is milled in the bushing to accommodate the drive gear. The entire cycle takes just fourteen seconds.

When the fan section is transferred to the finishing machine, a diameter is turned and a shoulder faced. Then a hole is counterbored for the packing gland, and the bushing pressed in on the first machine is reamed. After a hole for an adjusting screw is tapped, the spindle-bearing hole is reamed and counterbored in one step. All finishing operations are performed in nineteen seconds.

The Bore-Matic performing the first series of operations on the field section reams the bearing hole, presses in a bushing, taps two 10-24 stud holes for brushes, and mills a 3/4-inch radius in the bushing for gear clearance. Total cycle time is fourteen seconds.

Six finishing operations on the field section are completed by one multiple tool. These consist of boring the field diameter, facing a shoulder, turning an outside diameter, counterboring the packing-gland hole, and reaming the armature-shaft bushing. Counterboring and reaming the spindle-bearing hole are combined in one operation with a step tool. Cycle time for the operation is nineteen seconds.

INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Magazine Feeds Wrappers at Constant Pressure

RALPH T. STEWART, Winston-Salem, N. C.

Wrappers or labels are fed from the top of the illustrated magazine. The edge of the wrapper is elevated by vacuum lifter *A* so that it is in position to be picked up by gripper *B* and pulled clear of the magazine. This feed arrangement is being used by the R. J. Reynolds Tobacco Co.

The most interesting feature of this device is that it maintains a constant pressure between the top of stacked wrappers *C* and the underside of stop-plates *D* and *E*. This is accomplished by means of a rack *F*, pinion *G*, and scroll *H*.

The various parts will assume the positions shown when the magazine is fully loaded. Weight of the wrappers or labels resting on pressure-plate *J* is offset by the magnitude of weights *K*, taking into consideration their distance from the rotational axis of pinion *G*. These weights are supported by a strap passing around the outer surface of the scroll.

As the wrappers are removed from the stack and the magazine begins to empty, the weight resting on pressure-plate *J* diminishes. At the same time, the scroll has been rotating in a clockwise direction. Due to the contour of the scroll, the lever arm of the weight becomes progressively shorter and the total force applied to the rack and pressure-plate is reduced proportionally. In this way, the wrappers are fed upward under an almost-constant pressure from the first to the last.

Materials fed by this system can be paper, foil, light cardboard, or almost any sheet stock. In most cases, only stacked weights *K* need be made lighter or heavier to accommodate the different materials. It should be noted that the bracket for securing this device to the machine frame is not shown, nor is the handwheel used to hold the pressure-plate in the downward position while the magazine is being reloaded.

Rotating scroll (H) alters the moment of the force applied at pinion (G), thereby reducing upward pressure on the stack as the magazine empties.

Remote Control Presets Spindle-Quill Travel

HIDEO SUZUKI, Tokyo, Japan

An arrangement that can be used to preset the length of travel of a spindle quill, tool-head, or work-table is shown in the accompanying illustration. Repeated and accurate positioning of one of these machine tool members from a remote point is achieved by the use of synchros.

Linear displacement of a spindle quill *A* is converted to rotation by means of a rack *B* and a gear train *C*. The output shaft of gear train *C* drives a transmitting synchro *D*. Components *A*, *B*, *C*, and *D* are built into the machine tool.

Synchro *D* is connected electrically to a receiving synchro *E* located at the remote position from which the machine tool is to be controlled. In this manner, angular displacements which represent the position of the spindle quill are transferred from synchro *D* to synchro *E*. The receiving synchro is connected by shaft *F* to a special dial type indicator *G*. A pointer *H* is attached to shaft *F*, and a second pointer *I*, which pivots on the same axis and is concentric with dial plate *J*, is driven through a reduction gear train *K*. Also driven by shaft *F*, gear train *K* reduces the rotation in the ratio of 100 to 1. Since rack *B* and gear train *C* are in a ratio such that one turn of shaft *F* and pointer *H* represents a 0.1-inch displacement of the spindle quill, one revolution of pointer *I* will, therefore, represent 10 inches of quill travel.

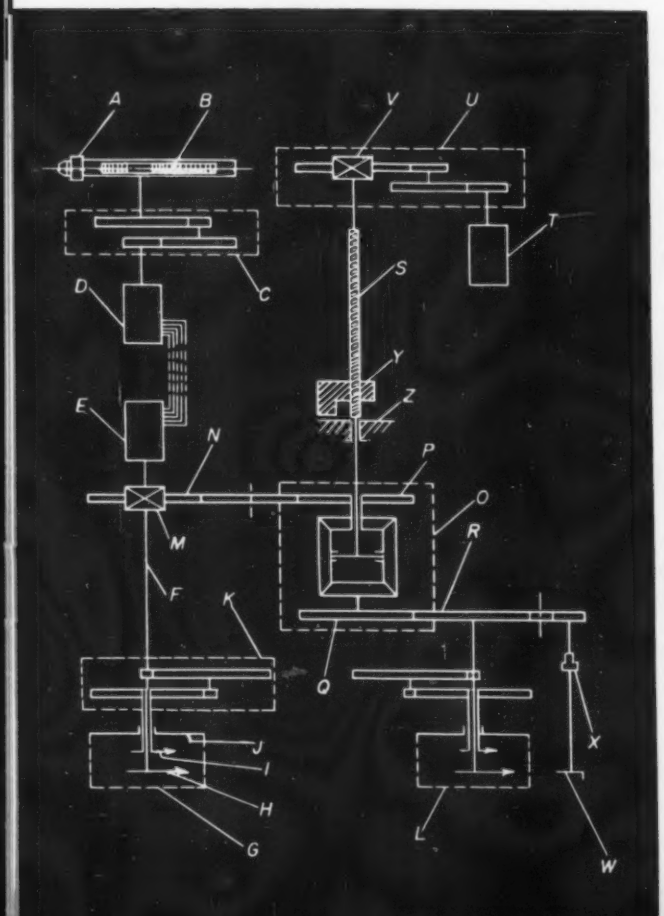
An electromagnetic clutch *M*, when actuated, allows shaft *F* to engage a gear *N*. This gear, in turn, drives a differential gear train *O* through an idler and gear *P*. The differential is connected through gears *Q* and *R* to a gear train and a dial indicator *L*. These are identical in design to members *K* and *G*, respectively.

A lead-screw S, which is used for setting quill travel, is also connected to the differential. Thus, if clutch *M* is engaged and gear *Q* is held in a fixed position, lead-screw S will drive shaft *F* through the differential in a ratio of 1 to 1.

An electric motor *T*, used for presetting quill travel, is connected to lead-screw S. This is done through a reduction gear train *U* and an electromagnetic clutch *V*. To preset quill travel, gear *P* is locked in place, gear *R* is released, and clutch *V* is actuated. Rotation of lead-screw S by means of the motor will then be transmitted through the differential and gear *R* to indicator *L*.

Manual presetting of quill travel is made possible by means of a handle *W* and a mechanical clutch *X*, which is geared to gear *R*. Manual rotation of handle *W* is in this way transmitted both to indicator *L* and lead-screw S. Clutch *V* should be disconnected and gear *P* locked in place when lead-screw S is preset manually. Actual control of quill travel is accomplished by means of a nut Y on lead-screw S and a plate Z, the movement of which opens a switch in the circuit supplying power to the quill-feed mechanism.

Operation of the remote quill-travel control is as follows: With gear *P* locked and nut Y in contact with plate Z, lead-screw S is rotated by actuating motor *T* or manually by rotating handle *W* until the desired length of travel is read on the dial of indicator *L*. This moves nut Y on screw S away from plate Z a distance proportional to the required quill travel. Movement of the quill for the desired travel with gear *R* locked and gear *P* released will then cause nut Y to return the same proportional distance in the opposite direction and contact plate Z, thus stopping the forward motion of the quill. During machining, indicator *G* shows the position of the quill.



Arrangement that permits remote presetting of the travel of a spindle quill, tool-head, or work-table.

TOOL ENGINEERING *Ideas*

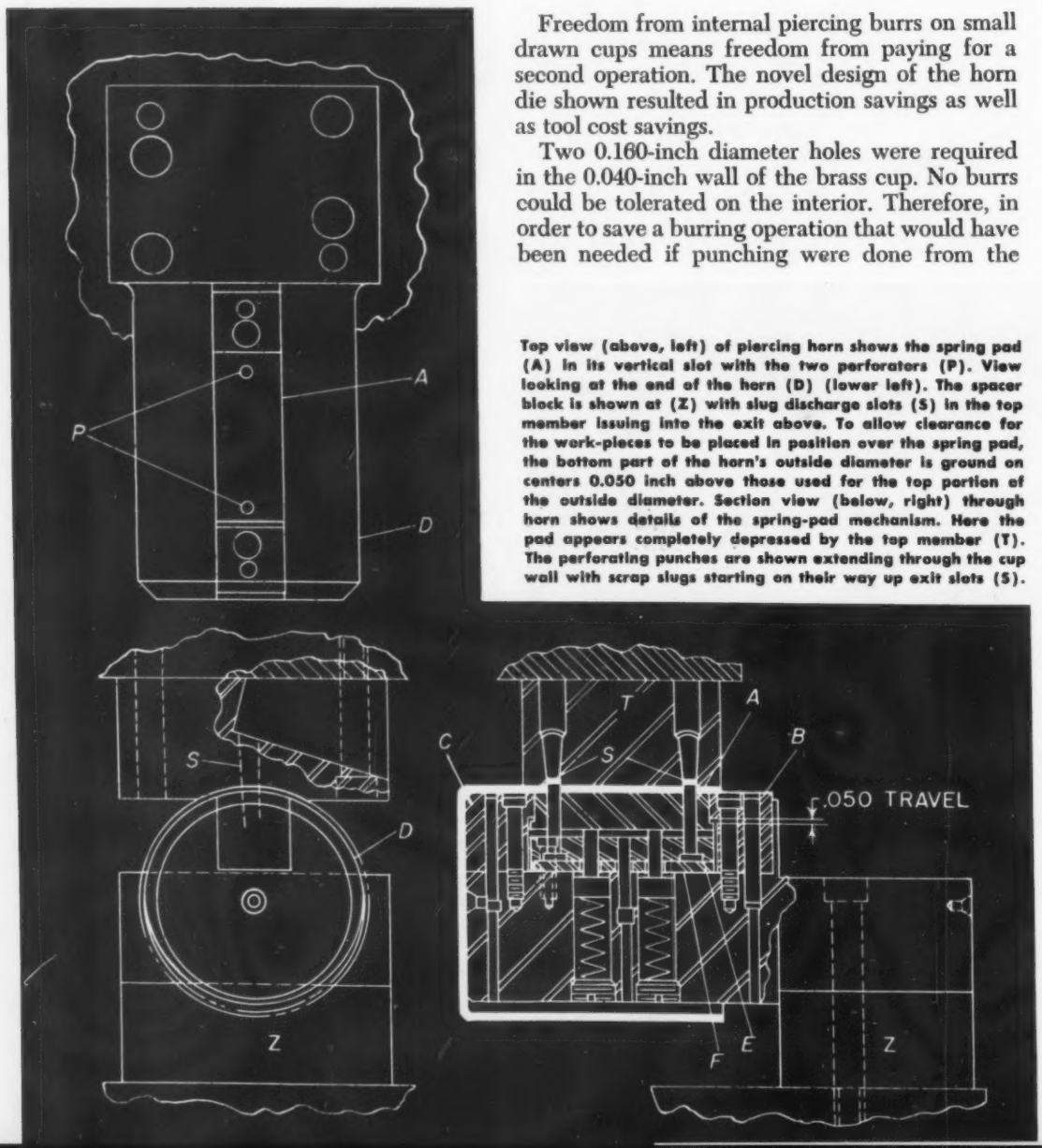
Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Wall of Cup Punched Without Burrs on Inside

F. MURRAY, Chicago, Ill.

Freedom from internal piercing burrs on small drawn cups means freedom from paying for a second operation. The novel design of the horn die shown resulted in production savings as well as tool cost savings.

Two 0.160-inch diameter holes were required in the 0.040-inch wall of the brass cup. No burrs could be tolerated on the interior. Therefore, in order to save a burring operation that would have been needed if punching were done from the



Top view (above, left) of piercing horn shows the spring pad (A) in its vertical slot with the two perforators (P). View looking at the end of the horn (D) (lower left). The spacer block is shown at (Z) with slug discharge slots (S) in the top member issuing into the exit above. To allow clearance for the work-pieces to be placed in position over the spring pad, the bottom part of the horn's outside diameter is ground on centers 0.050 inch above those used for the top portion of the outside diameter. Section view (below, right) through horn shows details of the spring-pad mechanism. Here the pad appears completely depressed by the top member (T). The perforating punches are shown extending through the cup wall with scrap slugs starting on their way up exit slots (S).

outside, the die was made for reverse punching with the perforators *P* in the horn *D*, the lower member.

The part is stripped from the stationary perforators by spring pad *A*, which, along with retaining blocks *B* and *C*, fits into a slot in the horn *D*. Spacing block Z holds the horn elevated above the die-holder. During the making of the die, material was left on the pad and retaining blocks so that they could be ground at assembly to the same radius as the horn.

The spring pad was positioned during grinding by a 0.050-inch shim placed between the pad and the retaining blocks. This thickness is the distance of pad travel. The pad was held in place by straight pins in the spring cavities. The pins were actuated by screw plugs.

Perforator plate *E* is positioned by a dowel and fastened by two screws, one of which is shown as a phantom in the sectional view.

When the perforating punches are sharpened, a shim (equal in thickness to the amount removed in sharpening) is placed under backing plate *F*.

Slots S for slug exit are provided in the upper die member, and a slug chute (not shown) guides this scrap out of the dies. This design of mounting the horn made the tools unusually easy to make, offsetting the fact that a little more tool steel was needed and more "roughing out" was required.

Lathe Attachment Drives Rotary Cutter

JOSEPH A. CIVITARESE, Lodi, N. J.

The cutting action of a standard lathe involves the passing of a fixed tool along the surface of a rotating work-piece. There are instances, however, where rotary cutters are used to advantage for producing various shapes on a lathe.

A rack-and-pinion attachment that permits such a tooling setup to be made is illustrated. This particular device was designed to generate cooling fins around the outer surface of a cylindrical housing. The arrangement includes a toolpost assembly, Fig. 1, that replaces the compound slide. Working in conjunction with the special toolpost is a support bracket, Fig. 2, that is clamped to the lathe bed. Also shown in Fig. 2 is the work-piece following machining.

Base *A* of the toolpost assembly (Fig. 1) is machined to permit mounting on the cross-slide of the lathe. Threaded into this base is post *B*, over which a sleeve *C* is accurately fitted. The flanged lower end of the sleeve is cut as a spur gear that meshes with teeth on a long rack *D*. Cover plate *E*, held to the base with machine screws, protects the teeth of both gear and rack from chips. An O-ring seal *F* increases this protection, while additional cover plates (not shown) shield exposed portions of the rack.

Cutter *G* threads onto the upper end of the sleeve and is held in place by lock-nut *H*. The sleeve, in turn, is held to the post by washer *J*, stud *K*, and adjusting nuts *L*.

The support bracket (Fig. 2) is clamped across the lathe bed by tightening bolts *M*. Bolt *N*

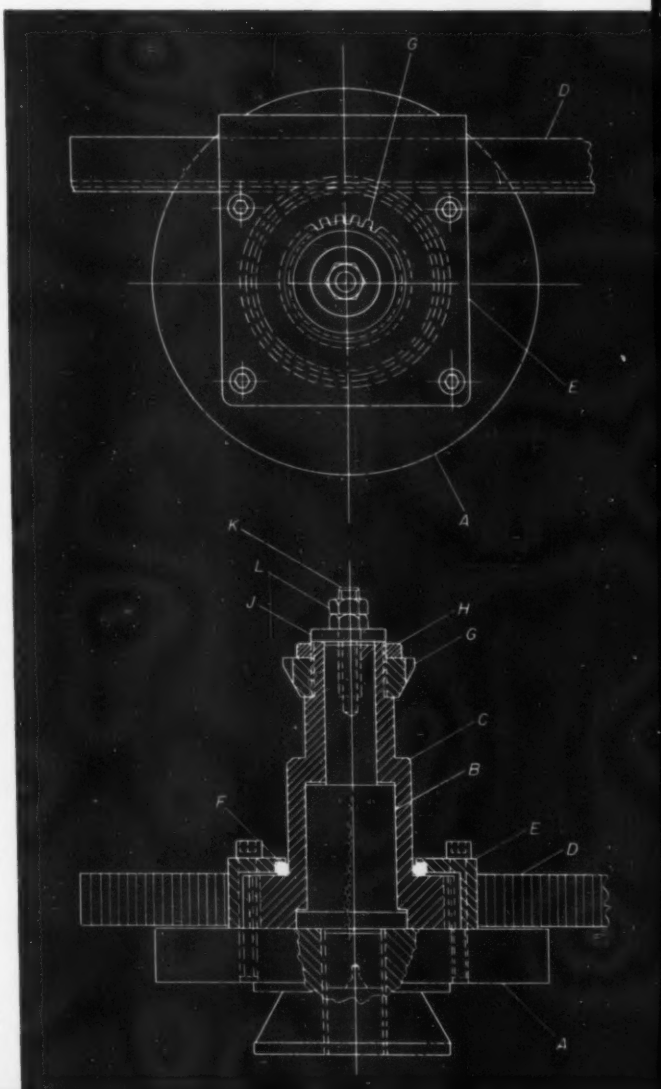


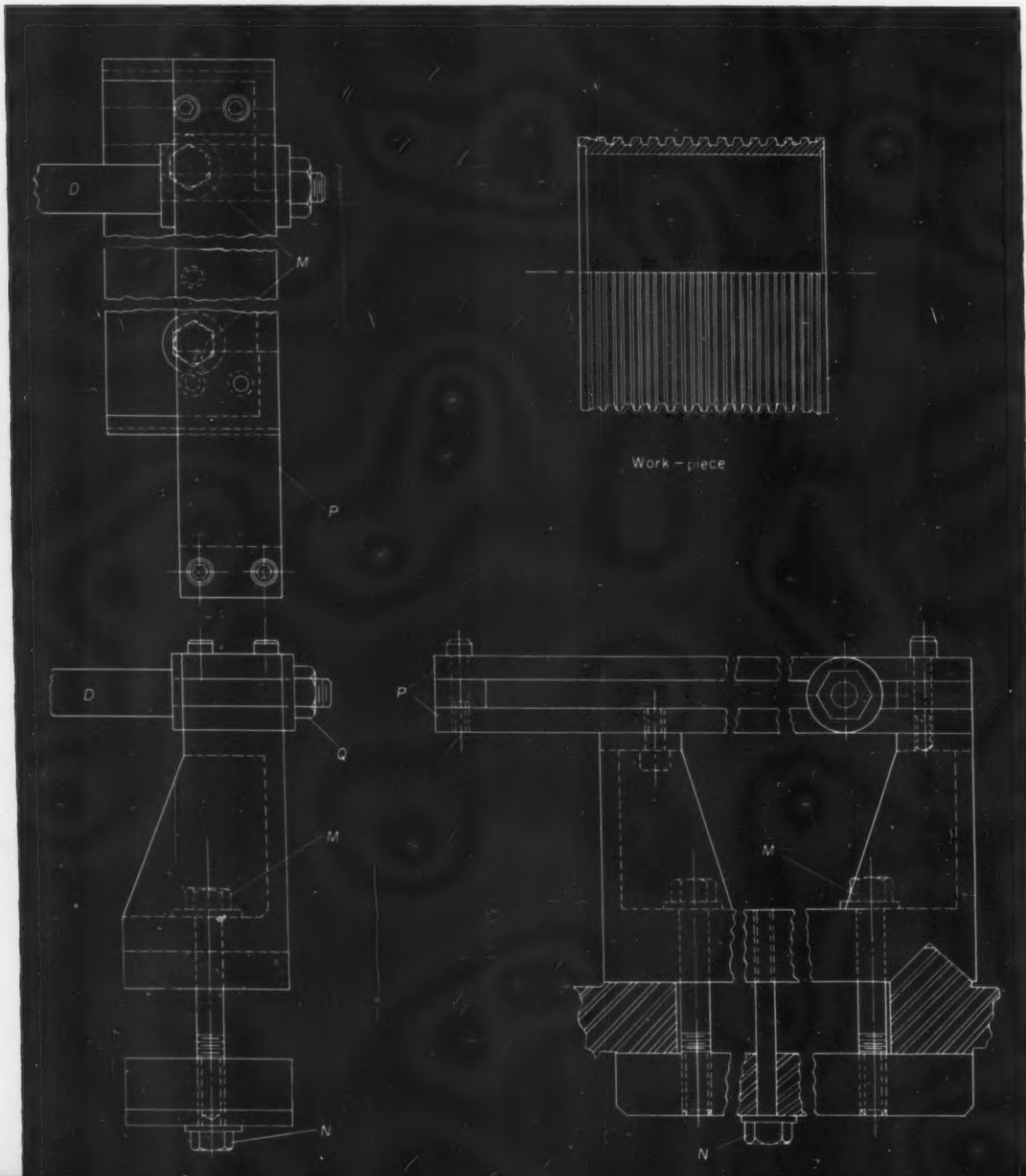
Fig. 1. Rack and pinion drive rotary cutting tool on this lathe attachment. Cutter is mounted on a special toolpost assembly that replaces the compound slide.

merely serves to hold the bracket together when not in use. The right-hand end of the gear rack *D* is free to slide between two guide plates at *P*. Length of the guide plates is sufficient to permit gear-rack adjustment to accommodate various diameters of work-piece. Also, the rack is long enough to suit any length of work-piece within the capacity of the lathe.

In operation, nut *Q* is loosened to permit cross-feed adjustment of the tool, then tightened for traverse feed. With the rack thus held stationary, traverse movement of the lathe carriage imparts a clockwise rotation to the cutter as it shapes the rotating work-piece.

Although the illustrated device was intended for one particular application, there are numerous other operations for which it can be adapted. For example, the rotary cutter could be a small template used to cut various shapes. Facing operations are possible by adapting the gear rack to the cross-slide of the lathe. Also, for straight finish turning, a plain rotary cutter given a counter-clockwise rotation (reversing the position of the rack) will yield improved cutting action and eliminate the thread-like appearance found on many turned parts. As this type of cutter presents more usable surface, even wear and extended tool life are by-products.

Fig. 2. Bracket supporting gear rack (D) is clamped to lathe bed. Position of the rack can be adjusted by sliding it between guide plates (P), then tightening nut (Q).



Small Milling Machine "Fits" Appliance Job

Small milling machines are often job size. This has been aptly demonstrated with resultant production economies by the Scott & Fetzer Co., Cleveland, Ohio, in the making of vacuum-cleaner nozzles for a multiple-purpose household appliance. Two accurate slots required in the nozzles (Fig. 1) permit them to be quickly and easily affixed to a single power source which can be connected in a similar fashion to a number of other specially designed attachments.

The milling of these slots is accomplished at the rate of 480 parts per hour on a No. 1 U. S. milling machine (heading illustration) equipped with an air-hydraulic table feed and an air-operated clamping fixture. The parts are simply inserted in the fixture and clamped; the rest of the operation is automatic. In moving the work to the cutter, the air-hydraulic system utilizes a cam attachment that provides an automatic rapid traverse, or "skip-jump" feed. The slots, 5/16 inch wide by 3/8 inch deep, are machined in two lugs 3 inches apart.

After the cutting cycle has been completed, the operator is then only required to remove the finished part and insert another one in the fixture. For these nozzles, which are die-cast from Type 380 aluminum alloy, a cutting speed of 1280 sfpm and a feed rate of approximately 200 ipm are used. Elapsed floor-to-floor time for the operation is only six seconds. In addition to the savings originating from the relatively low initial cost of a small machine, a 20 per cent reduction in time and labor has been attained.

Fig. 1. The lugs on the upper of these two vacuum-cleaner nozzles were slotted at the rate of 480 pieces per hour on the machine seen in the heading illustration. Lugs on lower part have not been milled.

Tighter microfinish requirements for air-vehicle parts continue to be demanded by the Government's reliability program. To meet its quality guarantees, a builder of landing gear has broadened its use of precision surface-analysis instruments

Surface analyzers prevent reliability-quality disputes

THE VOLUME INSPECTION of fine surface finishes on critical airframe parts becomes extremely expensive without effective quality standards. A common language must exist between machine operators and inspectors, as well as between outside vendors and a company's incoming inspection. Of supreme importance is the need for a reliable instrument by which surface quality can be checked against the standard. The surface-analyzing instrument must be highly reliable to avoid error disagreement, waste of time, and needless backtracking. The need for highly accurate measuring equipment has become heightened by the missile reliability program.

The achievement of accurate surface finish is especially critical at Cleveland Pneumatic Tool Co. (CPT) of Cleveland, Ohio, where landing gear, parts, and allied assemblies are produced

for commercial and military aircraft. The high speed of modern planes is one of the main reasons fine microfinishes are required. With a high microfinish the possibility of generating surface heat is reduced because the fine finish at high speeds is much less conducive to air friction. Microfinished parts perform more reliably and also give longer life, since moving parts in contact with one another operate smoothly and evenly with less vibration and fatigue.

With the number of different types of parts handled in one year at CPT reaching 20,000 to 30,000, it is necessary to have a handy standard reference instrument in all inspection areas to resolve any doubts as to whether parts should be passed, rejected, or reworked. Reliability of finish must be guaranteed by CPT as a subcontractor. As long as specifications call for a given finish on piston gears and other parts, the company must produce within the specified range. Normally, by honing a part to 2 to 4 micro-inches, close tolerances can be assured. On occasion it is necessary to lap selected surfaces to 1 micro-inch.

The reference instrument used to check out finishes at CPT is Brush Instruments' Surfindicator, a surface analyzer. A number of these instruments are located at strategic points throughout the plant, Fig. 1. The analyzer can consistently measure finishes to 1 micro-inch.

In addition to landing gear systems, critical components for the Polaris missile are produced here, as well as many sizes of liquid springs. Liquid springs are compact, small, low-weight shock-mitigation systems. The main differences between the liquid-spring concept and that of landing gear are two: the entire chamber of the spring is filled with oil, and the piston is considerably smaller than the bore diameter of the cylinder. As an example, the load supported by a 9-inch diameter piston of a conventional landing gear can be supported by a liquid-spring piston having a diameter of only 2 inches. Liquid springs are used by the Army in transporting Redstone missiles on flat cars, and by the Navy as a shock-mitigation system for the Polaris missile.

CPT has its advanced quality-control program closely integrated with production operations. This includes inspection instruments and procedures at receiving, and final and various stages of processing, Fig. 2. Any off-tolerance part, whether processed at CPT or by a subcontractor, must be covered by a corrective action report. In the case of disagreements over standards there is a materiel review board to rule on borderline cases. Procedure may require a 100 per cent check for newly developed components or just an occasional spot check for in-process parts. Checks are generally made by instrument at an inspection department area, but sometimes it is necessary to make the check directly on the machine where the part is being turned or ground without removal of the work from centers. The surface analyzer can be mounted near or directly on the machine, where it can be easily viewed by the operator. The instrument is not affected by magnetic fields, vibration, or line-voltage fluctuations. Since many parts for landing gear are too large to be easily moved, the indicator is frequently carried to the part to be inspected, Fig. 3. The portability and ease of handling of the instruments make on-line inspection simple.

Rather than having a single expert inspector make all the necessary surface-finish measurements with the indicator, CPT has found it more convenient to train a large group in the use of surface analyzers. Thus, over 200 inspectors and in-process line workers are capable of making a competent surface-finish measurement at any time. It takes at least one day of intensive study for an inspector to learn the operation of the Brush Surfindicator, and at least one month of on-the-job training to become proficient for inspections in which the instrument probe must be hand-held rather than motor-driven (Fig. 4).

The receiving inspection department checks incoming parts from over 300 suppliers for finish and dimensional tolerances, in accordance with company and Air Force approved quality-control standards. The company has established quality-control standards, procedures, and qualification tests. These are contained in printed manuals which, in all cases, conform to or surpass customer and USAF standards. Subcontractor ven-

Fig. 1. (Left) A steering cylinder for the landing gear in an 880 Convair jet is checked in receiving inspection. Here the inside diameter is checked with a motor-driven standard probe to measure finish, which must be kept to 32 micro-inches.

Fig. 2. (Above) In-process inspection of finish is performed by a machine operator during grinding of this Boeing 707 jet landing gear piston.

Fig. 3. (Right) For large, heavy parts the instrument is carried to the piston, where a surface finish of 16 micro-inches is checked after grinding.

dors are required to meet or exceed CPT standards. Thus, parts will automatically pass USAF standards.

The company discovered that poor finish on certain purchased parts resulted because the supplier furnishing the part did not completely understand surface-finish control and measurement. As a result, different groups of suppliers are invited to the CPT plant to attend seminars on surface-finish measurements and control, from time to time.

Vendors, especially those who have been shipping substandard products, are invited to the quality-control seminars. During these sessions the vendor is shown how he can bring his product up to acceptable standards. Standards are explained and methods of measurement are demonstrated. In many cases, the vendor sees the desirability of using the identical test instrument employed by CPT to assure consistent quality. The company's quality-control department rates its list of vendors monthly and strives constantly to reduce the percentage of rejected parts. Vendors who cannot bring their products up to the accepted standard are eliminated from the list of approved suppliers. By bringing in vendors to the plant and training them in surface-finish analysis, CPT realized substantial savings because the instruction program results in fewer rejects and therefore less material handling.

The plant's receiving inspection department checks between 5000 and 10,000 different parts each month. Inspectors checking finish are trained to use both the motor-driven probe and the hand-held probe. The major portion of the parts checked requires a 10- to 5-micro-inch finish, but smaller parts, such as piston rods, have a finish requirement as tight as 2 micro-inches.

Fig. 4. The surface finish on the lobe of a cam is checked with a hand-held probe. The cam is part of a wing-tip landing gear. The finish, which is 32 micro-inches, can also be checked with a motor-driven probe.

As skin-heat-producing speeds create a demand for the lower micro-inch finish, the methods of obtaining these finishes and checking them out must also improve. Although 16 micro-inches is a critical finish in large parts today, the company anticipates that before long it will be down to 2 or 1. Smoother finishes can be obtained, as has been demonstrated, on the smaller parts, and surface measurements down to 1 micro-inch are common. However, it is recognized that in the future it will be necessary to measure below 1 micro-inch. Steps are under way to produce and measure these surfaces with a high reliability.

Multiple Press Bending Speeds Tubular-Frame Production

Bends of different angles and radii are made in multiple work-pieces by a single press stroke. Coining is often combined with bending to further cut costs

MULTIPLE BENDING is the simultaneous forming of two or more bends in one or more work-pieces with each press stroke. Whereas all bends are made in the same plane, different angles and radii can be formed. Use of multiple-bending operations at a midwest concern has resulted in increased production and reduced costs. A veteran tube fabricator, the company manufactures school furniture and components for the metal furniture and appliance industries.

Many tubular furniture frames have U-shaped sections particularly suitable for multiple press bending. For these operations, the company uses multiple-groove dies in a bending press made by Pines Engineering Co., Inc., Aurora, Ill.

Straight tubes are first loaded in the grooves of the clamp, and wing dies employed and positioned against a stop (Fig. 1). As the ram-mounted punch die moves downward, the work-pieces are contacted and firmly held by hydraulic pressure exerted through the lower clamp die. With continued downward movement of the ram, the parts are wrapped against the die-shoes by twin air-cushioned wing dies which move on ways within the holders as bending progresses. Twin air cylinders provide the cushioning pressures through the holder crank arms. This arrangement eliminates rubbing and marring, and helps to produce accurate bends.

The sectioned ram-mounted dies can be spaced to make frames with various distances between bends. Where the bend angles approach or exceed 90 degrees, the end sections of the upper dies are actuated by a cam that moves them into the extended position for the bending stroke. Springs then retract the sections as shown in the heading illustration, releasing the part to permit fast unloading. An interchange of cams allows the forming of U-bends with different leg spacings.

Four Bends and Two Coining Operations Combined

U-frames for school furniture are produced two at a time by dies with double grooves. In each frame, two bends of different radii are made approximately 10 inches apart and a coining operation is simultaneously performed at the center. The work-pieces are 44-inch lengths of 1 1/8-inch outside-diameter steel tubing having a 0.065-inch wall. They are swaged at both ends prior to bending. One bend is of 71 degrees formed on a 3-inch center-line radius, and the other is of 82 degrees on a 4-inch radius.

Fig. 1. Two straight lengths of steel tubing located and clamped for bending. At the end of the press cycle, the sectioned punch die retracts as seen in the heading illustration, releasing the tubes from the die.

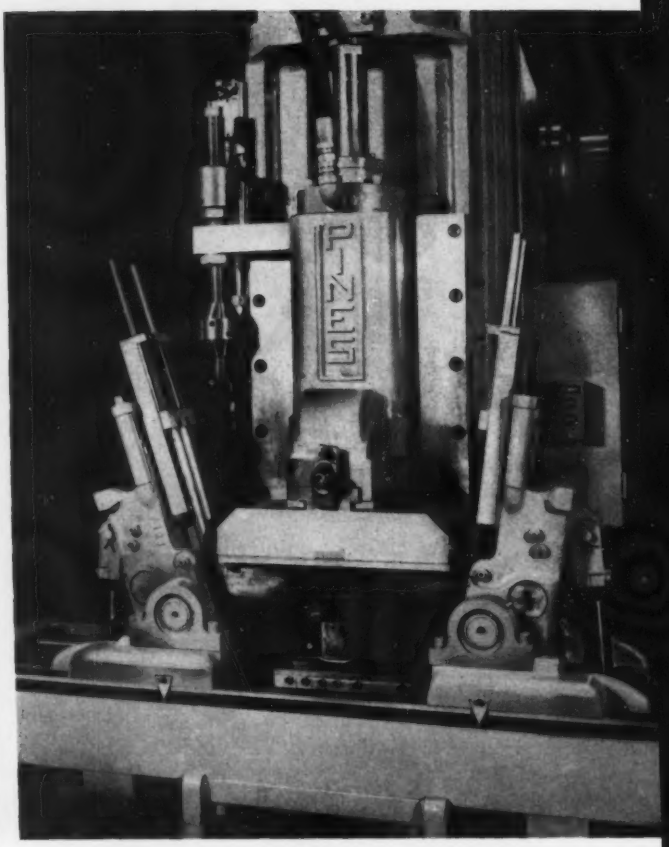


Fig. 2. Here, at the end of the forming stroke, the positions of the wing dies show the difference in the bend angles. The block in the ram-mounted die has coined a flat area at the center of the U-frame.

Midway between the bends an area 2 inches long is flattened to one-half the tube diameter. In Fig. 2, the bending and coining of these U-frames have been completed and the parts are about to be released from the press. The flat is produced as the work-pieces are clamped by a coining die-block that can be mounted either in the ram die or in the lower clamp die. This interchangeability allows the use of the same set of dies for the production of frames with either top or bottom flats.

A completed leg section of a students' desk chair consists of two welded cross frames (Fig. 3), one coined on the top and the other on the bottom. Production by this method average 1000 bends and 500 coining operations an hour. Formerly 300 bends an hour were obtained, separate handling having been required for each bend because of the two different radii. In addition, the

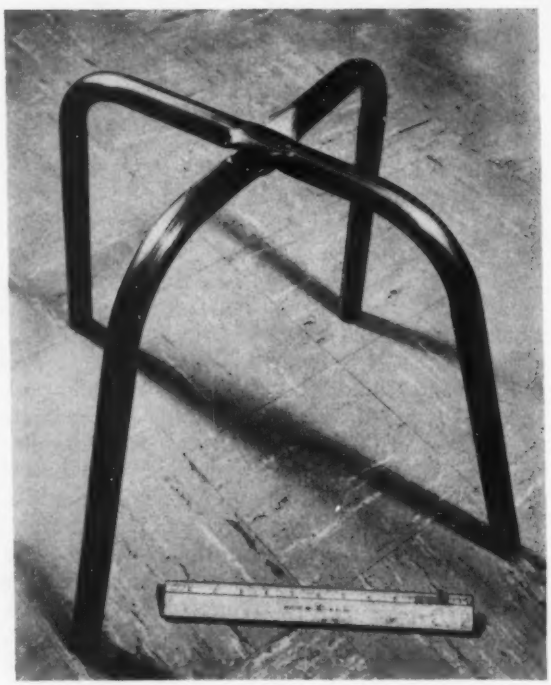


Fig. 3. Shaped by multiple press bending, these coined U-frames are crossed in the manner illustrated and welded to form legs for school furniture.

coined flat on each frame was produced in another press operation.

Changes of the tooling setup on the bending press to accommodate other types and sizes of frames average less than an hour. This includes replacement of the wing dies, the clamp die, and the ram-mounted punch die; setting of the wing die positions; and adjustment of ram stroke for the new work-piece.

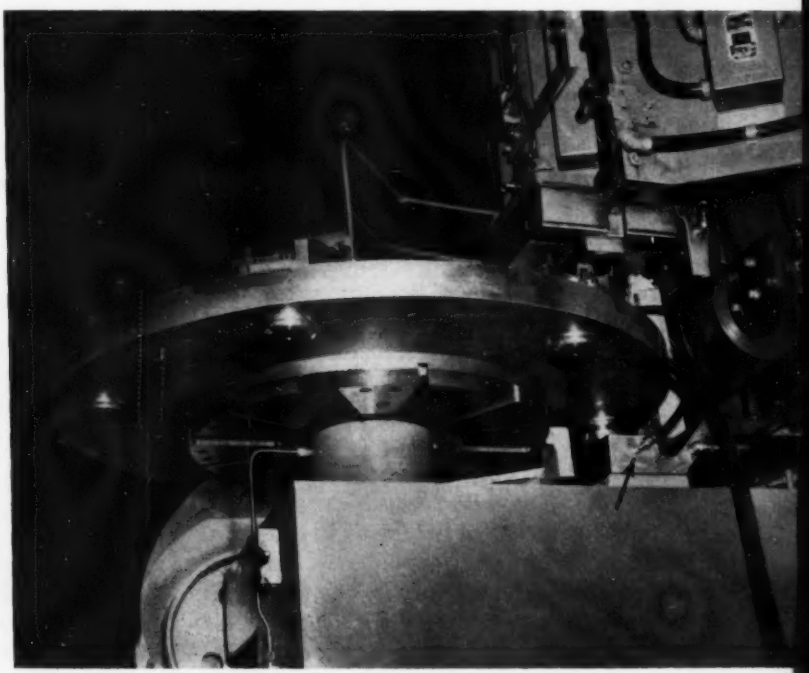
Among other jobs for which the company employs multiple press bending are back-leg support sections for dinette chairs. One size, formed from 1-inch outside-diameter, 0.042-inch wall steel tubing, requires two 90-degree bends 12 5/8 inches apart on a 3-inch center-line radius. Another size requires two 90-degree bends 10 1/2 inches apart on a 1 3/4-inch center-line radius in 3/4-inch diameter, 0.049-inch wall tubing. On both work-pieces average production exceeds 1000 bends an hour, compared to 300 bends by a former method. Collapsible type punch dies are used to speed unloading.

Quick-Change Tooling Simplifies Resistance-Welding Setups

Changing dies on dial-feed resistance-welding machines has been simplified as a result of new tooling designed for use with non-ferrous indexing tables. The new design "floats" the die in a bronze bushing that is fitted in the magnesium or aluminum table. Bushings are machined for a running clearance but hold close concentricity tolerances for precise work. Added to the quick-change, slip-fit feature is a self-aligning arrangement using side positioning bars to prevent the die from rotating. To change dies, only the water cooling connection need be broken.

Welding current is carried by the die itself as it contacts a conductor pad beneath the indexing table (arrow). The pad is an integral part of the lower secondary. This tooling, combined with the use of non-ferrous tables, permitted machine design changes which eliminated the usual lower secondary lamination and the air-activated shoe required to carry current to cast-copper tables for direct welding.

Another advantage of this design is its ability to reduce pitting and wear caused by dirt, grit, and grease on the current contact points. Here, the floating die wipes the conductor pad clean as the die is indexed into position. This new tooling has been used successfully on a number of machines built recently by the National Electric Welding Machines Co., Bay City, Mich., for welding automotive parts.



Worm's-eye view of resistance-welding machine shows dies projecting through underside of non-ferrous dial table. The die in welding position at the right rests on conductor pad (arrow).

2 reports shed light on electrolytic grinding

Experimental studies in the fundamentals of two variations of electrolytic grinding—abstracts of papers presented at a recent meeting of the American Society of Mechanical Engineers

Electrolytic grinding is generally accomplished on conventional equipment modified to permit the passage of a heavy direct current from the work-piece to a metal-bonded wheel through an ionized fluid. Material is thus removed from a part simultaneously by electrolysis and by the abrasive in the wheel. One important advantage of the process is reduced grinding pressures. This not only extends wheel life but can eliminate heat effects such as grinding cracks and tempering of the work. In addition, burrs are preferentially attacked by the electrolytic action. The benefit of large wheel-work contact areas when grinding with cup-wheels has encouraged the use of this method.

1. Peripheral grinding

W. R. BACKER and R. A. DAHLIN
Research Engineers, Machine Tool Division
Norton Co., Worcester, Mass.

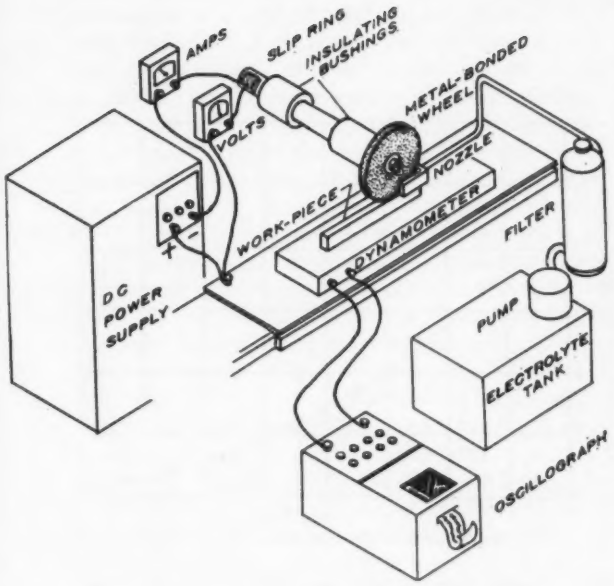
THIS RESEARCH was designed to discover the effects of electrolytic assistance on peripheral grinding in terms of basic variables. To accomplish this, a 6- by 18-inch hydraulic surface-grinding machine was equipped with a 300-ampere direct-current power supply. Adaptation of this machine for the process (see illustration on opposite page) included insulating the spindle; adding a slip ring to the spindle to connect the power supply; providing low, variable table speed; and installing a special shrouded fluid nozzle.

2. Grinding with cup-wheels

RENO R. COLE, Professor of Engineering
University of California, Los Angeles

ANSWERS to the questions, How much metal removal in electrolytic grinding is mechanical? How much is electrolytic? and What is the Faraday current efficiency of the electrolytic portion? were the intent of this investigation. Possible explanations were also sought for some of the phenomena that have been observed in use of the process.

The equipment employed included a Hammond tool grinder specially designed for the electrolytic process. This machine has a spindle speed of 3450 rpm, the wheel speed being held constant throughout the investigation. The electrolyzing current is brought to the wheel through

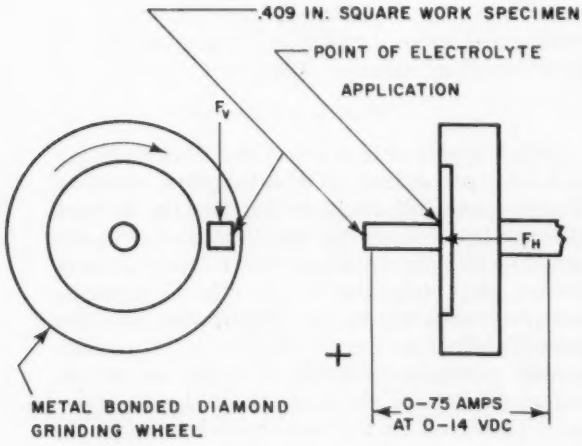


An external fluid tank was charged with a commercial electrolyte (principally potassium and sodium nitrites mixed at a rate of 1 pound per gallon of water) and a filter was installed between the tank and the nozzle. Work-pieces were clamped in a fixture containing dynamometric elements sensitive to both vertical and horizontal forces. These forces were recorded on an oscillograph, while meters indicated the electrolytic voltage and current. All cuts were made by plunge grinding, usually on a 3/4-inch wide work-piece.

A diamond wheel was used on cemented carbide. Metal-bonded wheels were necessary to conduct the large currents employed. Dressing was done by a standard technique and consisted of using a brake-controlled, vitrified-bonded, silicon-carbide dressing wheel followed by timed electrolytic deplating to accentuate the protrusion of grit. Reproducibility of dressing was difficult, but was approximated by a trial cut on a steel work-piece under fixed condtions. The resultant electrolytic current was considered the measure of repeatability.

brushes on the electrically insulated spindle. The anode connection is made to the table, which is free to move on ball bearings toward or away from the wheel. A constant pressure was maintained between the work and the wheels by means of weights attached to the table. Basic features of the experimental setup are shown in the illustration below.

The cup type grinding wheel used was 6 inches in diameter and had a 3/4-inch rim width. It was made of phosphor bronze and had a 100-mesh size diamond distributed at a concentration of 72 carats per cubic inch of wheel material. The electrolyzing current source was an Anocut unit having a capacity of 300 amperes at 14 volts direct current. This equipment utilizes selenium rectifiers and suppresses surges of electrolyzing current caused by sparking between the work and the wheel.



A beam type strain-gage dynamometer permitted measurement of the forces F_V and F_H independent both of the amount of specimen which had been removed and of temperature effects. Electrolyzing current, total electrical quantity, and electrolyte flow rate were also measured.

Grinding specimens were made from 7/16-inch square hot-rolled plain carbon steel having a nominal analysis of: C, 1.0 per cent; Mn, 0.30 per cent; S, 0.015 per cent (max.); P, 0.025 per cent (max.); and Si 0.30 per cent (max.). They were austenitized, brine-quenched, and tempered to a hardness of 62 to 64 Rockwell C, then ground to produce specimens with a 0.409-inch square cross section.

The electrolyte was a water solution of 10 per cent potassium nitrate and 5 per cent potassium

1. Peripheral grinding

Hydrodynamic Force Is Produced

The apparatus was designed to provide two force components so that a grinding-force ratio could be computed. The intent was to find if the electrolysis had any effect on the friction in grinding. This phase of the research was abandoned, however, when a hydrodynamic force was found to be present between the wheel and work-piece.

A vertical force on the work-piece materializes before there is mechanical contact with the wheel. The hydrodynamic origin of the force was verified, since it disappeared when the electrolyte was omitted. Experience has indicated that this force does not exist in conventional grinding because of the porosity of a vitrified wheel. A metal-bonded wheel allows pressure to build up between it and the work-piece by an action that is similar in nature to that of the oil film in a journal bearing.

The dependence of the hydrodynamic force on clearance is shown in Fig. 1. It was found to be the same when electrolysis was proceeding. While grinding (negative clearance), the vertical force is greatest.

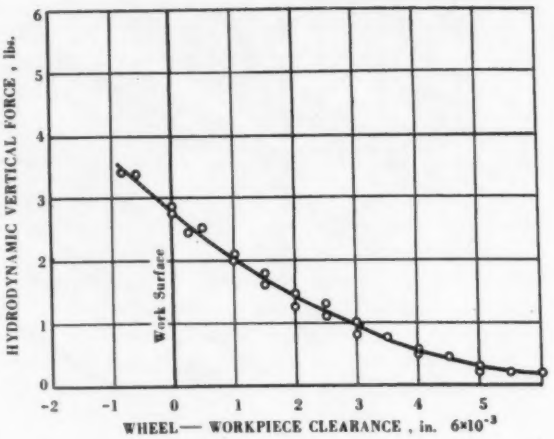


Fig. 1. Graph showing how the vertical hydrodynamic force varied with the clearance between the metal-bonded wheel and work-piece. The wheel speed employed was 5250 sfpm.

2. Grinding with cup-wheels

nitrite, the latter added as a rust inhibitor to help protect the grinder from corrosion.

Since it was found that the current density was dependent on the amount of electrolyte which entered the interface between the work and the wheel, and this in turn was affected by the electrolyte flow rate and the particular place on the wheel where the electrolyte was applied, it was necessary to control these variables. Optimum and controllable application of electrolyte was achieved by an antisplash device which gave reproducible results and much higher current densities than could be obtained by applying electrolyte to the center of the wheel through a flexible tube. All experimental runs were made at an electrolyte flow rate which permitted small rate changes without an appreciable effect on current density.

Discussion of Results

The influence of the current density and the electrolyte flow rate and concentration on the grinding rate for the standard process was first investigated. An analysis of the results show that the total grinding rate W is dependent on the current density and is, within limits, substantially a linear function of the latter, Fig. 1. Such factors as electrolyte concentration, which seem to affect total removal rate, do this through their effect on current density. However, total removal rate, in addition to being dependent on electrolytic removal rate W_E, is evidently also dependent on mechanical removal rate W_M, due to conventional grinding-wheel abrasion. Thus,

$$W = W_M + W_E \qquad (1$$

It first appeared that one of the objectives (to find what percentage of W is due to W_M and to W_E, respectively) could be attained by making an experimental run in which rate of removal would be measured without electrolyzing current flowing, thus obtaining W_M directly. However, it was observed early in the investigation that the force F_V decreases as the electrolyzing current density increases. This can be explained by assuming that enough hydrogen from the electrolysis is produced in the work-wheel interface to

Grinding Cemented Carbide

The progressive effect of metal removal on the mechanical and electrolytic action occurring in the grinding of cemented carbide can be seen in Fig. 2. As material is removed from the work-piece the current passing through the electrolyte rises. One role of the abrasive grain is to maintain a gap between the work-piece(anode) and the wheel (cathode). As the abrasive wears, the gap narrows; so, for a given voltage, the current increases. The tangential-force curve shown in Fig. 2 supports this theory. At first, the force rises because of the progressive dulling of the abrasive grain. As the anodic reaction increases with larger currents, less material must be ground away; so the force levels off and even drops. Although a full wheel-life test was not run, it is apparent that if the wheel work-piece gap becomes very small, there will be arcing in the gap.

Current density is controlled by the size of the gap, which depends on the protrusion of abrasive grit from the wheel face and the penetration of the grit into the work-piece. For a given wheel, wheel speed, and dressing, the gap size, and thus the current density, should correlate with the mean undeformed cross-sectional area of the chips produced in the operation.

The equations for current density, the mean undeformed cross-sectional area of the chips, and the wheel-work contact area allowed the effect of chip geometry on current density to be judged by the influence of the quantity $v\,(d)^{1/2}$,
where v = work speed, inches per minute
d = depth of cut, inches

For the cemented carbide, this effect can be seen in Fig. 3. Many combinations of table speed and depth of cut were used, but all data were taken for one wheel dressing. Similar curves, but with different slopes and origins, were found after each dressing.

Two parameters of electrolytic action were used. The current efficiency C is the percentage of metal removed electrolytically compared to the theoretical electrolytic removal rate for the actual current I, according to Faraday's law. It is determined as follows:

$$C = 100\,\frac{(M - M_0)}{K\,I} \qquad (1)$$

where K is the cubic inches of material deplated per minute for 1 ampere of current, according to

exert a force F_G on the work specimen. The force F_G exerted by the gas plus the mechanical force F_M exerted by the wheel would in this case be equal to the horizontal force F_H. The force balance equation would then be:

$$F_H = F_G + F_M \qquad (2)$$

with the mechanical friction relationship

$$F_V = fF_M \qquad (3)$$

This gives:

$$F_V = f(F_H - F_G) \qquad (4)$$

Since F_H and f (the grinding coefficient of friction), are constant and F_G is here assumed due to evolution of hydrogen gas and hence dependent on current density, equation (4) would explain the observed dependence of F_V on current density.

Whereas F_V and f can be determined experimentally, F_M can be found from equation (3) for any current density under electrolyzing conditions. The value F_M can be looked on as the value of F_H corrected by the amount of force F_G exerted by hydrogen-gas evolution at any current density.

The data of Fig. 2 were obtained by making experimental runs with no current flowing. The relative percentages of W due to W_M given in Fig. 3 were obtained by calculating F_M for any current density and then obtaining the corresponding value of W_M from Fig. 2.

The percentage of mechanical removal shown

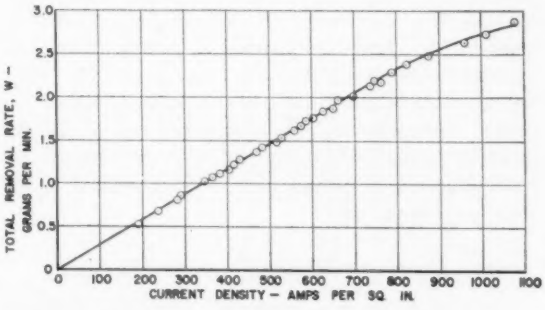


Fig. 1. Experimental curve of current density versus total grinding rate (W). Grinding force (F_H) was 14.7 pounds; electrolyte flow, 0.32 gallons per minute.

1. Peripheral grinding

Faraday's law. The second parameter is the per cent electrolysis E which indicates the relative amount of metal removed by electrolytic action:

$$E = 100\,\frac{(M - M_g)}{M} \qquad (2)$$

In Equations (1) and (2), the value of M was found by measuring the work-piece before and after a cut, and from the table velocity. The value of M_g was computed from the tangential force, wheel speed, and specific mechanical energy of metal removal u:

$$M_g = FV/u \qquad (3)$$

The specific energy of metal removal was determined from cuts made without electrolysis.

The current efficiency and per cent electrolysis could not be correlated with any of the machine variables. Tests run at 4 and 6 volts were compared; the results are listed in the accompanying table. The difference between the electrolytic action at these voltage levels has a low order of significance. The mean per cent electrolysis was 55. This was computed from tangential-force data which averaged only 45 per cent of the force when grinding without electrolytic assistance. On the other hand, a change from the metal-bonded wheel to a vitrified wheel produced a 50 per cent drop in tangential force. Thus, the force with electrolytic assistance and a metal-bonded wheel was only a little lower than that with a vitrified wheel alone.

Electrolytic Effects When Grinding Cemented Carbide

Applied Voltage	Current Efficiency, Per Cent		Electrolysis, Per Cent	
	Mean	Standard Deviation	Mean	Standard Deviation
4	52	10	54	10
6	47	13	56	13

Conditions: work speeds, 3/4 to 12 inches per minute; depth of cut, 0.001 to 0.020 inch; number of tests, 45.

Discussion of Results

Mean values of current density are dependent on the cross-sectional area of the chips, but in peripheral grinding this area varies along the wheel-work contact arc. The actual current density where the chip is thickest can be expected to be much higher than the mean. Arcing will

2. Grinding with cup-wheels

in Fig. 3 is surprisingly low. However, the diamond wheel used was not intended for mechanical abrasion but rather for wear resistance. Thus the diamond particles used in making this wheel were smooth rather than sharp. Very little wheel wear was observed in more than a year of experimental use.

The grinding coefficient of friction f used in calculating F_M was determined experimentally by measuring F_V using the dynamometer with electrolyte flow but with the electrolyzing current turned off. The best value selected from the various experimental runs was $f = 0.10$. This value is low compared with that reported by other investigators for conventional grinding wheels, again indicating that the percentage of total material removal due to mechanical abrasion is quite small.

Determining Faraday Current Efficiency

As a second objective it was desired to determine, as accurately as experimental conditions permitted, the actual Faraday current efficiency which is attained in the electrolytic part of this grinding method.

The current efficiency can be calculated from the experimentally observed removal rate of material W, corrected by the rate of mechanical removal of W_M, and the corresponding total elec-

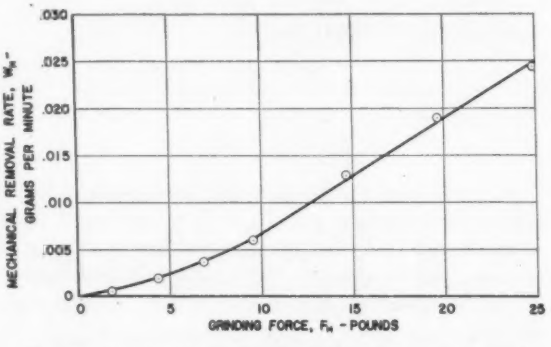


Fig. 2. Graph of mechanical removal rate plotted against grinding force (F_M)—here $F_M = F_H$. Electrolyte was used but no electrolyzing current. Grinding force (F_H) and electrolytic flow were the same as for the curve in Fig. 1.

occur when the current density becomes too high; therefore peripheral electrolytically assisted grinding will be limited by the maximum cross-sectional area of the chip.

It is desirable to limit current density without sacrificing productivity. Since the metal-removal rate is $v\,d\,b$ (where b = width of cut, inches) while the current density depends on $v(d)^{1/2}$, the use of a large depth of cut with a very low table speed is preferred. High productivity is obtained, yet current densities are reasonable. Machines should provide table speeds of a few inches a minute, while depths of cut can be on the order of 0.050 inch. Large wheel diameters help by increasing the wheel-work contact area and reducing the cross-sectional chip area.

Grinding forces are affected in several ways by electrolytic assistance. The metal-bonded wheel causes a hydrodynamic force to exist between the wheel and the work. It also raises the specific energy of mechanical metal removal. Electrolysis reduces the forces by relieving the abrasive of some work; thus the tangential force may be small even with the higher specific energy.

The electrolytic action can proceed if the wheel passes the work without mechanical intertrical quantity used to effect the removal. In order to do this the electrode reaction which takes place at the anode must be known.

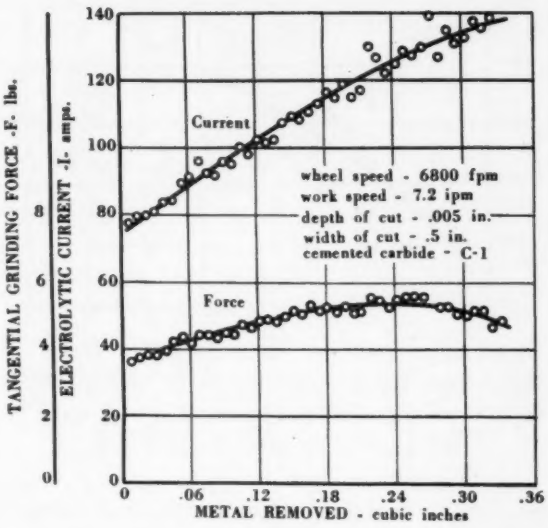

TANGENTIAL GRINDING FORCE -F- lbs.
ELECTROLYTIC CURRENT -I- amps.
Current
Force
wheel speed - 6800 fpm
work speed - 7.2 ipm
depth of cut - .005 in.
width of cut - .5 in.
cemented carbide - C-1
METAL REMOVED - cubic inches

Fig. 2. Progressive effect of material removal on the tangential force and electrolytic current required for grinding cemented carbide.

The usually accepted anode reaction for iron in alkaline solution and the one most consistent with the known electropotentials is:

$$Fe + 2OH^- = Fe(OH)_2 + 2e^- \qquad (5)$$

In the presence of air the $Fe(OH)_2$ is immediately oxidized to $Fe(OH)_3$. The $Fe(OH)_3$ precipitates and in the process is removed by a filter provided in the electrolyte system of the grinder. Since the oxidation reaction is not involved in the electrolysis, the total electrolytic reaction is:

$$Fe + 2H_2O = Fe(OH)_2 + H_2 \qquad (6)$$

Equation (6) permits calculation of the Faraday current efficiency if correction for mechanical removal is made.

The calculated current-efficiency results are given in Fig. 4. It is remarkable that for current densities up to about 700 amperes per square inch, anode current efficiency is, within experimental error, substantially 100 per cent. Conventional industrial electrolytic processes employ current densities which do not much exceed 1 ampere per square inch for the reason that current efficiency falls off markedly if higher current densities are used. This is particularly true of iron electrolysis, since iron becomes anodically passive at quite low current densities.

It is generally believed that the anode passiva-

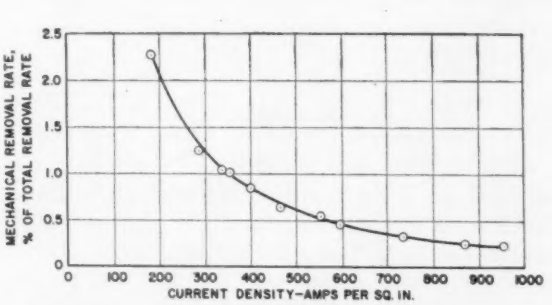


Fig. 3. Mechanical removal rate in per cent of total removal rate versus current density for the process. Values were obtained by calculation and from the data in Fig. 1.

1. Peripheral grinding

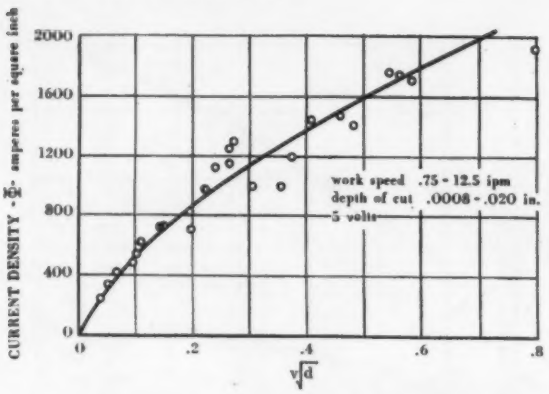


Fig. 3. Variation of current density (Φ) with grinding conditions as correlated by means of work speed (v) and depth of cut (d) in the term $v\sqrt{d}$.

ference. This deplating of metal without grinding could make parts undersize. On the other hand, the hydrodynamic force would tend to spring the wheel away from the work, leaving parts oversize. It was found that dimensional accuracy was best if substantial stock was removed on the final pass. For example, it was better to remove 0.010 inch in two passes of 0.005 inch each, rather than one of 0.008 inch and two of 0.001 inch. Where only a small depth of metal is to be removed, accuracy can be maintained by increasing the table speed or reducing the electrolytic voltage.

Faraday's law is useful as an indicator of the potential of electrolytically assisted grinding for processing a metal. However, the current efficiency must be considered in applying this law to practical jobs. Then too, the electrolyte must be capable of an anodic reaction with the work.

Summary

In electrolytically assisted grinding the gap between the wheel and work is determined by the protrusion of abrasive from the wheel face and by the chip geometry. This gap, in turn, determines the current density for a given voltage. Current density and the wheel-work contact area control the electrolytic current. The efficiency of this current transmission, and the electrochemical equivalent of the work, determine the rate of electrolytic deplating. Grinding-machine settings fix the total metal-removal rate. The difference between the total metal removed and the electrolytic deplating is the amount of metal that must be ground away by the abrasive.

2. Grinding with cup-wheels

tion of iron is due to the formation of a thin, invisible film of iron oxide, and it is known that this type of passivity can be removed by mechanical scraping. The practically 100 per cent current efficiency at very high current densities observed here is therefore attributed to the scraping action of the abrasive particles of the grinding wheel combined with the scrubbing action of the electrolyte as it passes through the work-wheel interface.

Summary

Grinding rate was found to be dependent only on mechanical removal rate and current density. Mechancal removal rate was less than 0.5 per cent of the total removal rate under nominal operating current density.

Faraday current efficiency for the electrolytic part of the process was constant and near 100 per cent up to extremely high current densities (700 amperes per square inch). This effect is attributed to the scraping action of the wheel abrasive which removes the oxide layer, preventing polarization of the anode.

Decrease in the wheel force on the work specimen in the direction of wheel motion with increase in current density, slight concavity of the ground specimen face, and the convex shape of the electrolyzing voltage-current curves are explained on the basis of hydrogen-gas pressure in the work-wheel interface.

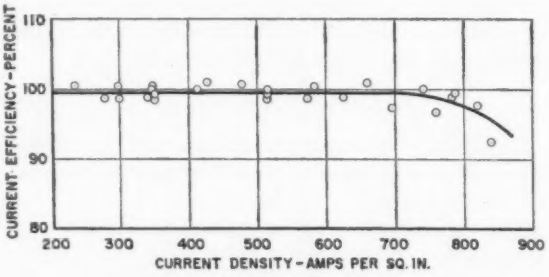


Fig. 4. Experimental curve of Faraday current efficiency versus current density. This graph is corrected for mechanical removal of material.

Paul B. Schubert

NEW MATERIALS

The properties and new applications of materials used in the mechanical industries

Precision Nylon Cut Gears with Metal Insert Hubs

A line of precision nylon cut gears with molded metal insert hubs has been developed by the Climax Metal Products Co., Cleveland, Ohio. Nymet, as the line is called, offers gears up to 3 inches in outside diameter and up to 1/2-inch face width as standard items. The gears are available in 48, 32, 24, 20, 16, and 12 pitches and in 14 1/2- and 20-degree pressure angles.

The strength factor of these gears is said to be the same as that for metal gears using the Lewis formula which assumes that the entire load is borne by a single tooth.

The hexagonal metal hub is locked in place radially by means of its shape and axially by means of a channel cut around the hexagonal face. This design is said to offer maximum resistance to shock, torsion, and vibration. The hubs, which can be provided plain or drilled and tapped with socket-head set-screws, are available in steel, stainless steel, brass, and aluminum.

Circle 565 on Readers' Service Card

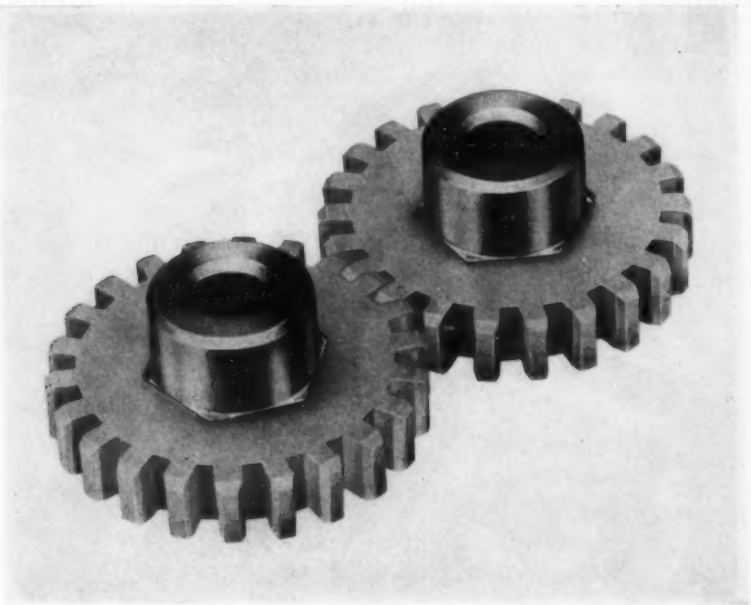
High-Speed Tool Steel for Hard-to-Cut Materials

A high-speed tool steel, designated Rex 49, for machining hard-to-cut metals such as highly alloyed steels at high hardness levels, stainless steels, superalloys, and titanium has been announced by the Crucible Steel Company of America, Pittsburgh, Pa. The steel can be heat-treated to Rockwell C 67 to 69. In the cutting of more normal materials, its use facilitates increases in speed, feed, or depth of cut.

Circle 566 on Readers' Service Card

Strip and Shim Stock with 0.0001-Inch Tolerances

The availability of both ferrous and nonferrous strip and shim stock with 0.0001-inch tolerances has been announced by Industrial Division, American Silver Co., Inc., Flushing, N. Y. Known as Ultra-Micro precision strip and shim stock, it is available in brass, steel, aluminum, titanium, stainless steel, and other metals in thicknesses



Shown here are precision nylon cut gears with metal insert hubs which are representative of a line of such gears recently made available.

from 0.0005 to 0.125 inch, and in widths up to 6 inches. The material finds use in the production of submicro precision parts used in aircraft, missiles, electronics, instruments, and controls.

Circle 567 on Readers' Service Card

Electrode for Low-Alloy, High-Tensile Steel Applications

A heavy-coated, shielded-arc type of low-alloy steel electrode, designated Speedex 710 Mo, has been made available by Metal & Thermit Corporation, Rahway, N. J. Classified as an E7010-A1 electrode, it meets requirements of this classification as specified by the American Welding Society and the American Society for Testing Materials.

The electrode can be used in all positions with direct current, reverse polarity. Weld deposits contain approximately 0.5 per cent molybdenum introduced through the coating. The electrodes are available in 1/8-, 5/32-, and 3/16-inch diameters, and are used in such applications as high-pressure piping in power plants and refineries, machine and structural fabrication, tanks, boilers, and casting repairs.

Circle 568 on Readers' Service Card

Permanent-Magnet Material that Can Be Easily Cut or Shaped

A lightweight, permanent-magnet material which has magnetic qualities comparable to sintered isotropic barium ferrite, yet which may be readily cut by ordinary tools, has been developed by the Leyman Corporation, Cincinnati, Ohio. Called Plastiform 1, the material is a rubber-bonded barium ferrite, magnetically oriented, with high coercive force and an energy product of approximately one million gauss oersteds.

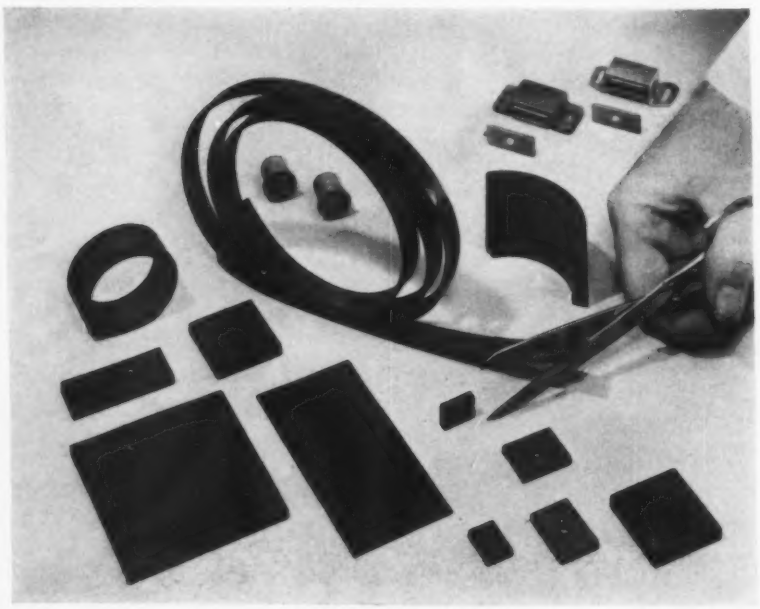
In contrast to sintered magnetic materials, Plastiform 1 is neither hard nor brittle, but may be easily machined or cut. Impact strength of the material is high, and it will not chip in use. Applications include magnetic cabinet latches, holding devices, toys and novelties, direct-current motors, and gasket inserts. It is supplied in many forms, such as rings, sheets, and strips.

Circle 569 on Readers' Service Card

Lubricant that Facilitates Working of Stainless Steel and Tough Metals

A lubricant that eases working of such hard-to-work metals as stainless steel, high-carbon steel, high-chromium steel, cast iron, and Monel has been developed by Anchor Chemical Co., Cleveland, Ohio. Called Anchorlube, it is considered an extremely clean lubricant, since it contains no oil and creates none of the difficult cleaning problems connected with white lead and similar materials. Lubricant is odor-free, harmless to the skin, and will not rust metals on which it is used. It is applied by swab, spray, roller, or brush. The lubricant is used in drilling, tapping, spot-facing, counterboring, milling, fly cutting, seat forming, engraving, broaching, drawing, piercing, punching, and hole extruding operations in the shop.

Circle 570 on Readers' Service Card



Easily cut with scissors or machined with conventional cutting tools, this rubber-bonded barium-ferrite magnet material is being used in magnetic latches, holding devices, and gasket inserts.

These are representative of the carat-sized man-made diamonds recently produced by scientists of the General Electric Research Laboratory, Schenectady, N. Y. They are large, dark in color, but not yet of sufficient mechanical strength for industrial use.

Circle 571 on Readers' Service Card

Heat-Resistant Paint for Use in Brazing and Welding Operations

A high-heat-resistant paint which protects steel jigs, fixtures, and formed products during brazing and welding operations has been announced by Speco, Inc., Cleveland, Ohio. Known as Heat-Rem H-170 Super, the paint is said to withstand heat at temperatures up to 1700 degrees F. It is available in both aluminum and clear vehicles. The paint is widely used on torch weld jigs on which rocket engine chambers are formed. It is applied by spraying, dipping, or brushing.

Circle 572 on Readers' Service Card

Drawn-Over-Mandrel Electric Resistance-Weld Tubing Now Available

The availability of a large number of sizes of cold-finished, drawn-over-mandrel electric resistance-weld tubing has been announced by Electricweld Tube Division, Jones & Laughlin Steel Corporation, Pittsburgh, Pa. Called J&L DOM Electricweld tubing, its advantages include ability to manufacture to close tolerances and good concentricity, surface finish, subsurface characteristics, and machinability.

Circle 573 on Readers' Service Card

Nickel-Plating Process with No Harmful Breakdown Products

A process for electroplating a coating of sulphur-free semibright nickel on metal surfaces has been announced by the Udylite Corporation, Detroit, Mich. The process, designated N2E, offers simple operation, uniformity of coating appearance, ease of control, and economical use of continuous filtration with activated carbon. It is said to produce no harmful breakdown products. Addition agents may be poured directly into the bath without first passing them through a filter, and bath temperatures of up to 150 degrees F. may be used for high-speed plating. The deposit is adaptable to buffing and scratch-brushing.

Circle 574 on Readers' Service Card

Magnesium Phototemplate-Layout Sheet as a Tooling Material

A tooling material which is very flat and is recommended for both diazo and blueprint methods of reproduction has been made available by the Dow Metal Products Co., Midland, Mich. The material, called Magnesium Phototemplate and Layout Sheet, is supplied chemically treated with a chromium pickled surface ready for priming or coated with a primer of the user's choice. The sheet is furnished in widths up to 60 inches, lengths up to 168 inches, and thicknesses up to 0.090 inch.

Circle 575 on Readers' Service Card

Alkaline-Solvent Compound for Stripping Paint Finishes

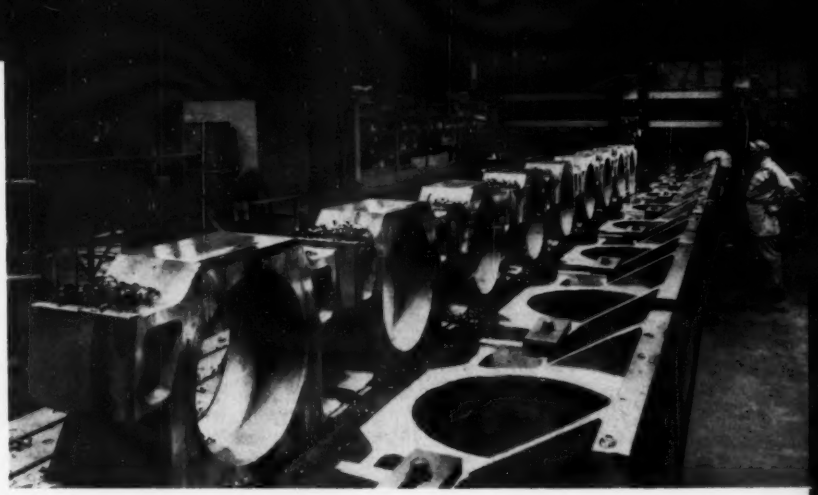
An alkaline-solvent compound designed to strip acrylic, alkyd, and other resistant paint finishes has been announced by Oakite Products, Inc., New York City. Oakite Stripper 150, as it is called, may be used in ordinary steel tanks; is safe on steel and magnesium; and is inhibited against attack on aluminum, zinc, and brass. It has no flash point and contains no phenolics.

Circle 576 on Readers' Service Card

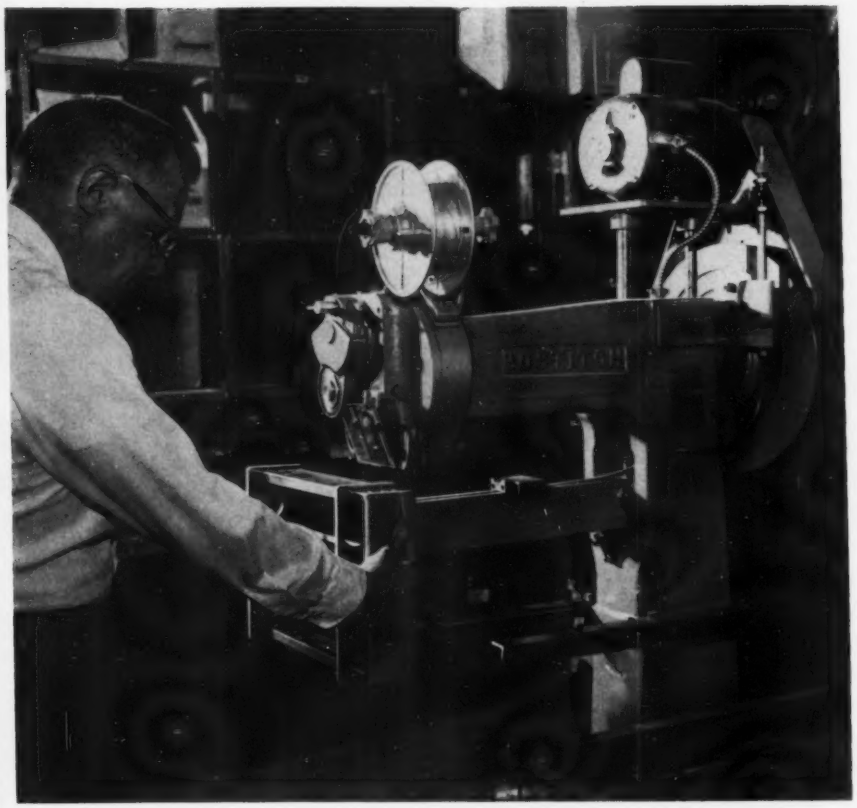
YOUNGSTOWN—Pushing the limits of both tooling and machine, tough forged gears and other parts for big rolling-mill equipment are machined automatically on single-spindle Warner & Swasey chucker at United Engineering & Foundry Co. Pieces are so large that they often require the full swing capacity of the machine. Heavy cuts up to 1 inch demand the drive motor's full 40 hp and may even involve temporary overloads. Nonetheless, tolerances are held within 0.001 inch.

In Shops Around the Country

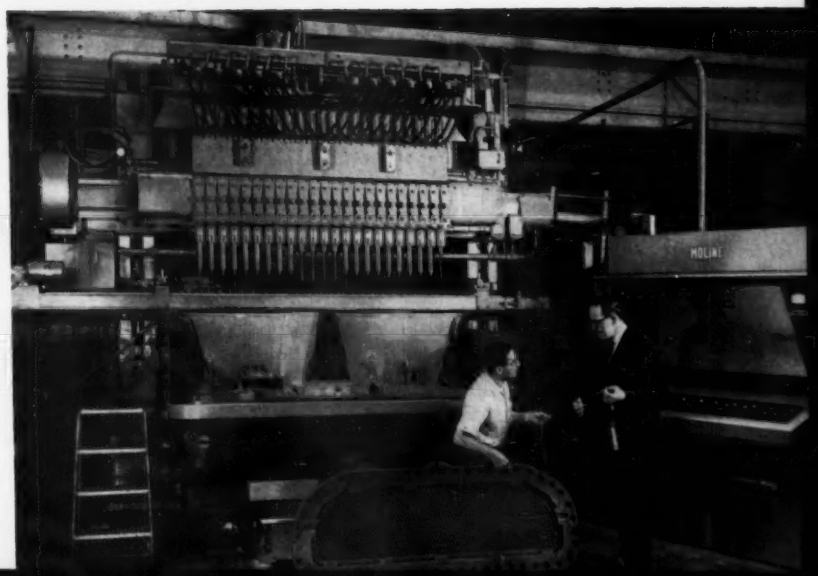
MINEOLA FIELD—Ultrapure atmosphere within another "sterile" atmosphere is the environment in which missile accelerometer suspension "strings" are turned on this Swiss screw machine from 0.030-inch beryllium-copper wire at Arma Division of American Bosch Arma Corporation. To assure absolute cleanliness during assembly and testing, the pressurized room is cleaned of all airborne particles over 1 micron.



WICHITA—Planing eighteen hinge-pin pillow blocks simultaneously for ground installation hardware for Atlas ICBM sites at Boeing Airplane Co.'s Wichita, Kans., Division. This is possible through development of a new holder which permits use of carbide throw-away cutting tips on a G. A. Gray planer. The new method allows man-hour savings per pillow block of nine hours and ten minutes.



MINNEAPOLIS—To help in the fabrication of a new residential electronic air cleaner being developed by Minneapolis-Honeywell, the pilot shop manager uses a Bostitch metal stitcher. Automatic foot-pedal action permits operator to use both hands to position work. Quick, secure fastening has proved exactly suited to the requirements. Machine staples together two sheets of 0.09-inch thicknesses.



SYRACUSE—Tape-controlled multiple-spindle drilling machine built for Carrier Air Conditioning Co. by Moline Tool Co. reduces production expenses and speeds up delivery of big-capacity cooling units. Here, Vice-President Frank A. Littlefield and drill operator examine one of 275 6-foot tapes which control the patterns of holes drilled in cooler and condenser tube sheets. Each tape replaces one of the heavy steel jigs (foreground) formerly used in drilling.

NEW DEVELOPMENTS IN

Machine tools, unit mechanisms, machine parts, and

Michigan Tool Automatic Grinder for Processing External Crown and Spur Gears

Machines developed to crown-grind the teeth of spherical gear type couplings, which can also be used to grind spur gears and splines, as well as "ease-off" surfaces near the ends of spur teeth, have been designed and built by the Gear Grinding Division, Michigan Tool Co., Detroit, Mich. These machines, designated Model CGG - 16x18FA crown - gear grinders, include provision for automatic dressing of the wheel to the proper form, as well as compensation for wheel wear. They can be preset for a completely automatic cycle of roughing, semifinishing, and finish grinding of gears having outside diameters up to 10 inches. They can also be operated as semi-automatic or manual cycle machines.

For finishing crowned gears, the automatic cycle is set to grind each tooth to "rough size" in a preselected number of cuts, with downfeed at each reversal of stroke; index to next tooth and reset head; feed wheel down and dress it after a selected number of teeth are rough-ground; semi-finish-grind all teeth in successive passes; feed wheel down and dress it after all teeth are semifinish-ground; and finish-grind all teeth in successive passes, and stop.

Grinding wheels from 6 inches in diameter down to 3 inches in

Automatic grinder for external crown gears announced by the Gear Grinding Division, Michigan Tool Co.

SHOP EQUIPMENT

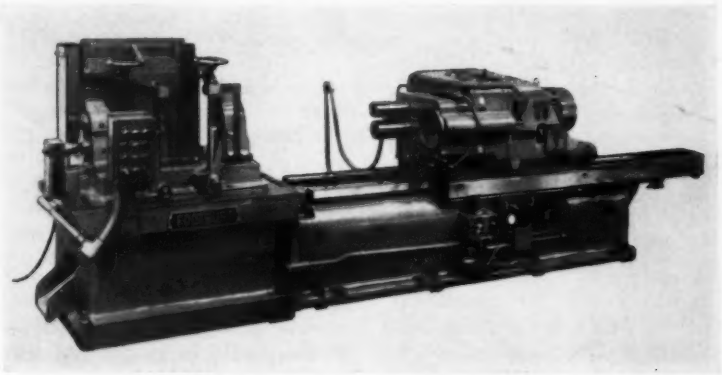
material-handling appliances recently introduced

diameter can be used. Because of the oscillating drive employed when crown grinding, the crown radius is not affected by the diameter of the grinding wheel. A crown radius up to 12 inches can be ground on gears up to 10 inches in diameter. The grinder has a 30-gallon capacity built-in coolant system which introduces the coolant through the wheel. The wheel is mounted on a precision, preloaded, ball-bearing motorized spindle which has a rating of 2 hp at 3600 rpm.

The automatic, hydraulically operated grinding-wheel feed is adjustable for total feed in any predetermined number of steps. The wheel-head is automatically reset at the time of indexing. Form templates are used with the hydraulically actuated diamond trimmer to trim wheels in preparation for grinding gears with diametral pitches within a range of from 64 to 4.

Some of the work-capacity specifications of these Model CGG-16x18FA grinders include: maximum outside diameter of gear, 10 inches; minimum root diameter, 3/4 inch; maximum distance between centers, 18 inches; maximum swing, 17 1/2 inches; maximum length of cut, 10 inches; and tooth range, 3 to 220 teeth. The maximum wheel-head travel is 13 1/2 inches; maximum table stroke, 32 inches; and maximum crown radius, 12 inches. The maximum oscillation angle is 45 degrees each side of center line. Maximum table speed is 116 cuts per minute for 2-inch face width, 98 cuts for 3-inch, and 88 cuts for 4-inch face widths.

Circle 577 on Readers' Service Card



Foote-Burt long-stroke boring machine for processing crankcases for large diesel and automotive engines

Long-Stroke Horizontal Boring Machine

A one-way, two-spindle, hydraulic-feed horizontal boring machine has been built by the Foote-Burt Co., Cleveland, Ohio, for use in the production of diesel and automotive engines in Brazil. The machine is equipped to generate two long high-precision holes simultaneously in large engine crankcases. In addition to boring the crankcase bearings, this machine will also size the babbit bushing bores for the camshafts. A unique feature of the machine is the hand-rotational positioning of the spindles to align the cutters with keyway type passages in the boring-bar guide bushings.

A 7 1/2-hp motor drives the dual spindle through a single drive gear. The speed of the camshaft spindle is three times that of the crankshaft spindle. A separate 3-hp hydraulic-feed pump provides both feed and rapid traverse for the return stroke. Adjustable dog type stops control the head stroke on the square ways.

Work loaded in the clamping fixture (left) is located from two previously reamed holes. Spindle No. 1 semifinish-bores the front crankshaft bearing, then advances to bore the rear bearing. Sumultaneously, spindle No. 2 semifinish-bores the camshaft bearings. After changing cutters, spindle No. 1 finish-bores the rear crankshaft bearing and rough-counterbores, chamfers, and finish-faces the rear bearing while spindle No. 2 finish-bores the camshaft bearings. After the camshaft bushings are pressed into their bored seats, spindle No. 2 machines the babbitt bushing to size while spindle No. 1 finish-bores the main crankshaft bearing and counterbores it from the rear side.

This type of horizontal gun-boring machine can be built with two, three, four, or more spindles for operation over a wide speed range. Spindles may be positioned by hand or automatically.

Circle 578 on Readers' Service Card

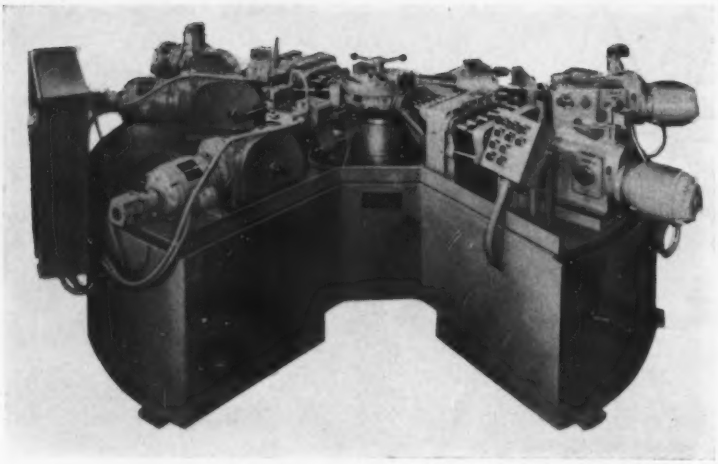


Fig. 1. One of three Edlund drilling machines equipped with fan type U. S. Drill heads employed by Raytheon Co. for angular peripheral drilling of gimbal ring for Hawk missile

Cost-Reducing Methods Developed for Production of Missile Part

Engineers of the Missile Systems Division of the Raytheon Co., working with those of the Edlund Machinery Co., Cortland, N. Y., and the United States Drill Head Co. of Cincinnati, Ohio, have developed a cost-reducing production method for the gimbal ring of the Hawk missile system being developed at the Raytheon Co.'s plant in Andover, Mass. During initial development of this missile, various parts were produced on single-spindle, hand-operated drill presses employing tumble type jigs. High scrap loss—due to the numerous loadings and unloadings, transferring of parts from one machine to another, and the resulting difficulty in holding rigid tolerances—contributed to an excessively high cost factor per missile. The equipment selected to overcome these difficulties in the case of the gimbal ring is shown in the accompanying illustrations.

Three Edlund machines of the type shown in Fig. 1 were selected for all of the drilling and tapping operations. Fan type drill heads of the design shown in Fig. 2, and regular drill heads made by the United States Drill Head Co., were installed on these machines. The fan type heads solved the problem of accurately drilling the many angularly positioned holes in the periphery of the work. The regular drill heads were used on each machine for the multiple-hole patterns.

The heads are driven by Edlund cam-feed units with a master control. The fan type head is actually a fixed head in that it does not move on the machine—the spindles are fed through the head at their proper angle and location by means of a pusher plate which is attached to the flange quill of the power unit. The spindle of the power unit extends through the pusher plate and into the back face of the head to provide the rotating motion for the spindles. Special gearing in the head accommodates angular mounting of the spindles. Some of the spindles are operated in excess of 2500 rpm. The maximum angle between spindle axes in this setup was 90 degrees. Spindles and idler shafts are all ball-bearing mounted. The spindles are superfinished, and the special gearing consists of shaved gears mounted on splines for smooth, positive, economical operation.

These fan type heads can also be employed on many other applications—on standard or special, vertical or horizontal type drilling machines—particularly for drilling parts where the axes are not parallel. Since they are custom-built units for specific job applications, mounting brackets and adapters can be arranged for easy installation and removal. Open design permits ready access to the spindle drill chucks for quick, easy drill changes, or the installation of taps and adapters for the economical drilling and tapping of hole pat-

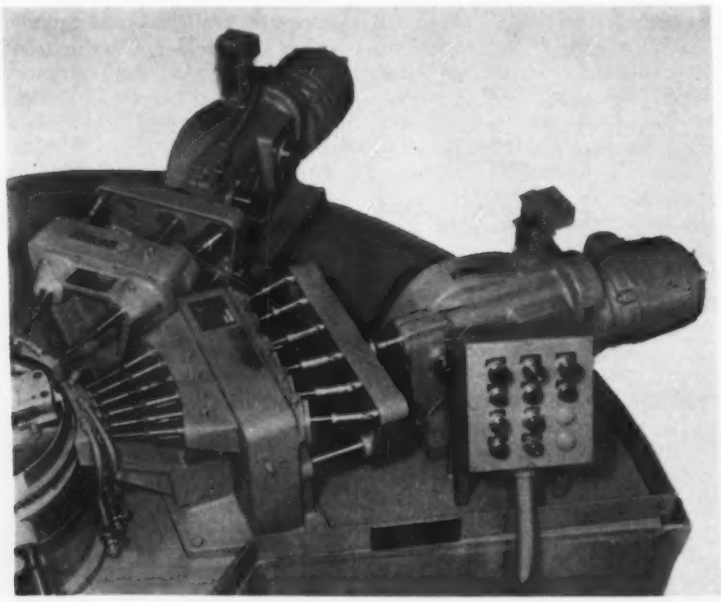


Fig. 2. Close-up of fan type and standard U. S. Drill Head equipment of Edlund drilling machine shown in Fig. 1

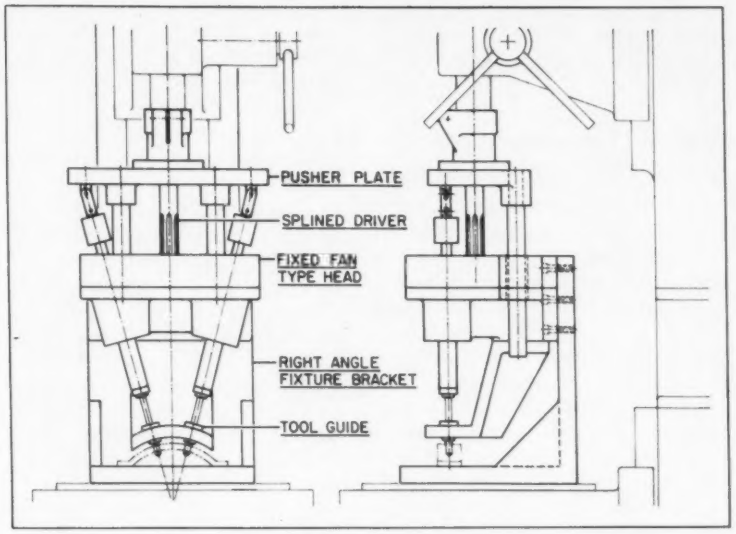


Fig. 3. Fan type U. S. Drill head with drill-press mounting adapter

terns with the same head. A regular fan type head with mounting adapter for use on a standard upright drill press is shown in diagram Fig. 3.

Circle 579 on Readers' Service Card

Cleveland Die-Casting Machine Incorporates Major Design Changes

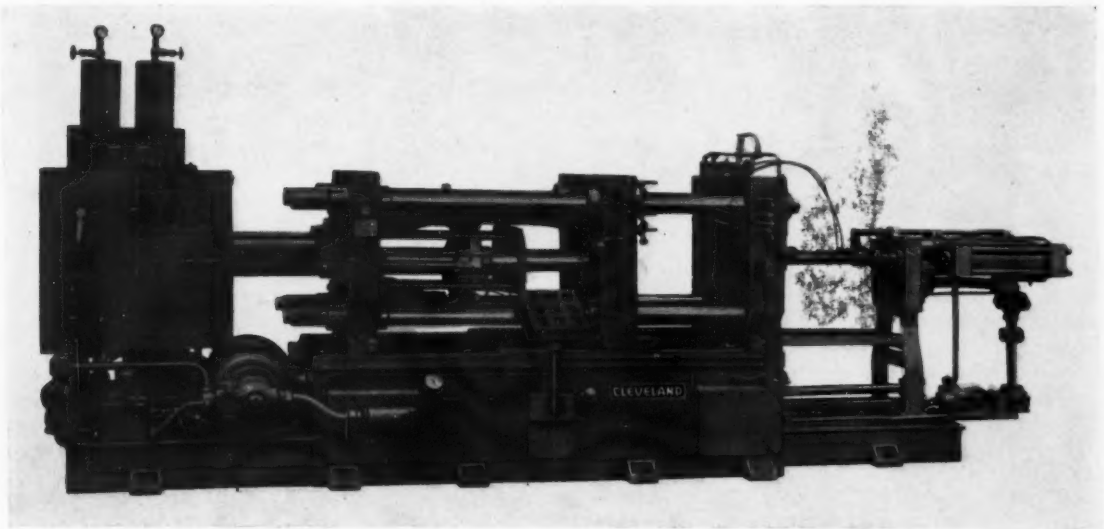
The Cleveland Automatic Machine Co., Cincinnati, Ohio, has incorporated major design changes in their Model 400 die-casting machine. This machine has a strain-gage-tested locking pressure of 400 tons or better, as tested by the Society of Die Casting Engineers' method using a calibrated test ring. The die-plates are 40 1/2 by 40 inches with a 20- by 24-inch space between tie-bars. Dies having a thickness range of from 12 to 32 inches and an adjustable die-opening range of 6 to 12 inches can be accommodated.

The cast-steel toggle mechanism has been positioned to operate in the horizontal plane to provide maximum accessibility for inserting ejector-pins. The movable platen is supported by rollers on hardened steel plates to relieve the four tie-bars of the weight of the platen and die. Ejector-pin holes and platen T-slots follow the SDCE recommended pattern.

The hydraulic system is built to JIC standards and is virtually leak-proof. The construction uses manifold piping with steel tubing and fittings. All lines 1 inch in diameter and over are welded. Die stroke is adjustable by turning a hand-wheel located on the center of the die-closing cylinder. Length of stroke is indicated by a calibrated scale.

Both the hot- and cold-chamber shot ends incorporate improved designs. The cold-chamber end employs a 4-inch diameter shot cylinder with a stroke that is adjustable from 14 to 18 inches. An intensifier is available which will generate plunger pressures up to 26,000 psi. The hot-chamber end includes an improved, 4-inch diameter cast-steel shot cylinder having a 7-inch stroke. The gooseneck supports are cast steel and are designed to permit easy adjustments and quick removal. Telescopic tubes are used, which eliminate swivel fittings.

The machine's electrical equipment is designed to JIC standards, and a modern electric control panel is mounted at the pump end. A convenient operator's push-button station is located at the nor-



Cleveland 400-ton die-casting machine with cold-chamber shot end and intensifier

mal working position. The machine's operating sequences are programmed by templates, providing maximum flexibility and safety of operation.

Circle 580 on Readers' Service Card

Lathe with Built-In Semimechanical Numerical Control

A precision Model 1610 Tape-r-guide lathe announced by the Barber-Colman Co., Rockford, Ill., has an integral tape system which actuates directly from digital data all mechanical functions required for the automatic performance of most lathe operations. Included in the simplified discrete data system—in addition to simple stopping, starting, positioning, speed adjusting, and feed changing—is the coordinated carriage and cross-slide actuation necessary for forming simple radii and turning tapers. The Tape-r-guide turns a variety of tapers without "hunting"; cuts chamfers without special tools; and does parting, boring, and internal operations—all automatically—under the control of a simple eight-channel binary code tape in the headstock.

Over-all accuracy of the control unit is limited only by the system resolution of plus or minus 0.001 inch on diameter and length. No provision for manual operation is said to be necessary. True tapers are produced by angular tool paths controlled by direct mechanical actuation. The relative speed of the carriage and cross-slide is controlled through mechanical clutches and compound differentials. No sensing or correcting of errors is necessary with this arrangement, and no electronic and data-storage equipment is used. An electrical signal from the taper reader initiates the desired mechanical cycle directly.

Another unique feature of this machine is its simplified tape-coding system. Only one row of the tape is needed for a complete axis command. Thus, only a few rows handle the complete command sequence. It is an incremental system, and coding is started from the first operation of the tool rather than from an absolute zero point.

A low-cost translator converts other binary code tapes into Tape-r-guide language, permitting manufacturers to take full advantage of this new Barber-Colman development without interfering with programming or coding procedures used for other numerically controlled machine tools. All operating controls are centralized on the headstock panel, adjacent to the tape reader. Four dials are provided for preselection of spindle speeds, actuated by tape commands at the proper time in the cycle. Another selector puts the machine into setup mode for incremental jogging of the cross-slide, or fully automatic cycling.

The lathe has an available swing capacity of 16 and 20 inches, infinitely variable spindle speeds to 1200 rpm, rapid traverse of cross-slide and carriage, and Meehanite castings throughout.

Circle 581 on Reader's Service Card

Barber-Colman Tape-r-guide precision lathe developed to combine numerical control with maximum economy

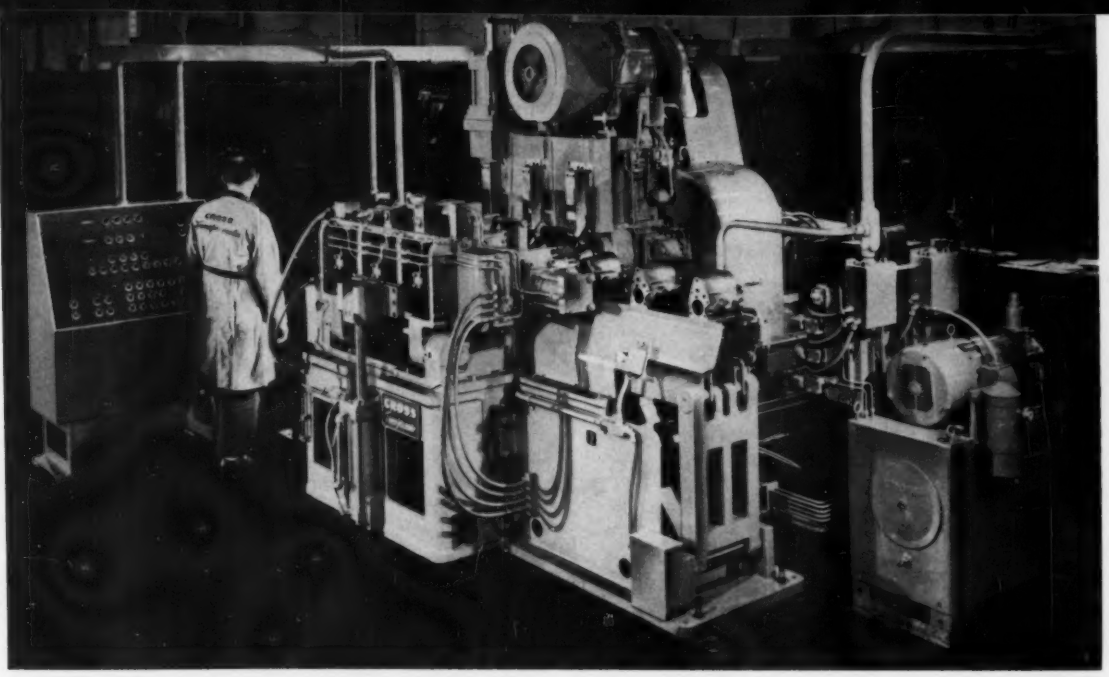


Fig. 1. Cross high-precision, high-production Transfer-matic built to finish-face both mounting surfaces of transmission cases

Cross High-Precision Transfer-matic for Processing Transmission Cases

The Cross Company, Detroit, Mich., has recently designed and built a three-station Transfer-matic, Fig. 1, for use in the mass production of automobile transmission cases. Outstanding features of this machine are its unusual materials-handling equipment and the accuracy with which it takes interrupted facing cuts. It holds flywheel-housing and transmission-extension mounting faces parallel and flat within 0.003 inch true indicator reading, and square with the main bore within 0.0035 inch on a 3.5-inch radius. A surface finish of 175 microinches is maintained despite the interrupted cuts on both ends of the work-piece.

In operation, three transmission cases are manually placed in the loading station with the shifter-rod holes down and the cover face to the left. Fig. 2 shows the three-position work station with the expanding arbors and their outboard supports. One of the spindle counterweights is located directly under the head end of the arbor, with the longitudinal locating pin visible directly underneath it. A lift-and-carry transfer mechanism is used to transfer the parts from loading station to machining station, three at a time.

In the machining station, the headstock advances and positions the driving arbors inside of the main bores of the transmission cases. A special mechanism positions the parts axially so that the dimension from the end face to the center line of the shifter hole is maintained. The drive arbors then expand in the main bores to clamp the parts, and the tailstock centers advance while the transfer bars are lowered. The main-drive motor then starts the rotation of the drive spindles and the single-point tools feed across the end faces.

When the cuts are finished, the main-drive spindles are stopped and the transmissions are positioned with the cover faces down. The arbors then release the parts, the transfer bar raises, the arbor and the tailstock centers withdraw, and the parts are transferred to the unload station where they are automatically removed with a special material-handling device.

The high degree of accuracy achieved by this Transfer-matic is said to result from: the fact that the parts are rotated on the axis of the main bore; the use of a driving arbor which precisely centers the part without distorting it; the balancing arrangement of the drive spindles; and the variable-speed drive that provides a constant cutting speed as the diameter of the cut changes.

Part orientation is an interesting feature of this Transfer-matic. The machine picks up parts in one attitude and unloads them in another because of an unusual spindle-positioning device tied in with the stopping mechanism. After the spindles have been completely stopped, the motor rotation is reversed and the spindles turn slowly in the reverse direction until they engage a latch. After latching, the transfer bars are raised, tailstock centers are withdrawn, and arbors are unclamped. As the arbors are withdrawn, there is a slight longitudinal displacement of the parts so that the tools can be returned to their starting positions without marring the finished end faces of the work.

The tools are repositioned during the forward transfer stroke of the transfer bars and, at the same time, the latch is rotated 90 degrees clockwise to be in position for the next set of parts. The latch is rotated 90 degrees counterclockwise during machining in order to be in the correct attitude for unloading. Positioning of the latch is accomplished by a gear segment driven by a separate fluid motor.

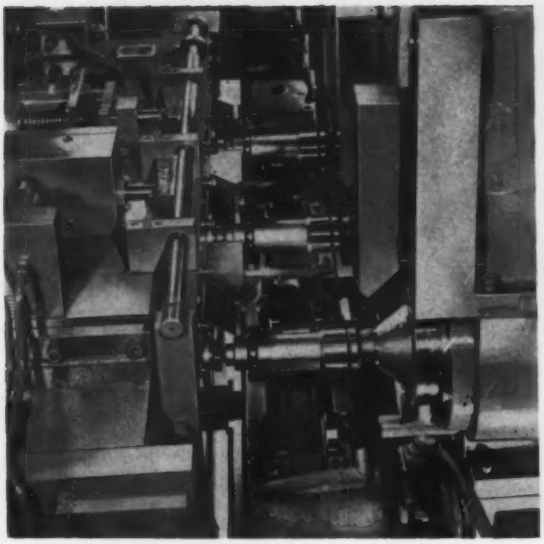


Fig. 2. Close-up of three-position work station of Cross Transfer-matic shown in Fig. 1

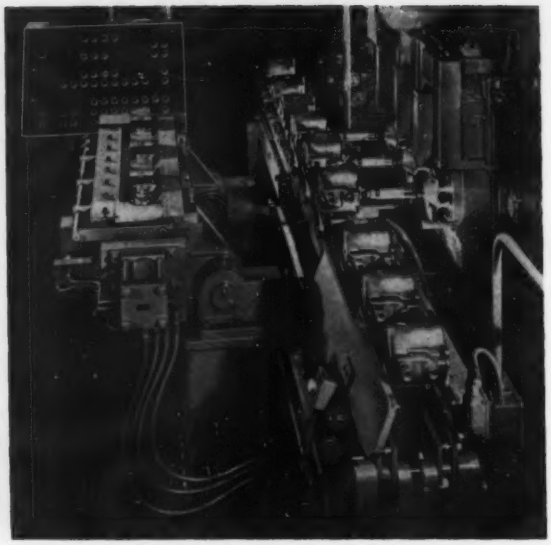


Fig. 3. Tool-slide of Cross machine shown in Fig. 1, tilted up to facilitate removal of tools

This part-orientation technique serves to accommodate the unusual automatic unloading requirements. The complete machine cycle is sixty-seven seconds, giving a production of about 130 cases per hour at 80 per cent efficiency. A swiveling tool-slide arrangement tips the rear facing tools up into a vertical position as shown in Fig. 3, making them easily accessible for tool changes. The tools are preset in the cartridges away from the machine, making them completely interchangeable and eliminating the need for trial cuts.

P&W Comparator Designed to Speed Up Tool Setting

An optical tool-setting comparator designed to facilitate the accurate positioning or setting of tools in adapters ready for use in numerically controlled and other machine tools requiring fast and frequent tool changes has been developed by the Pratt & Whitney Co., Inc., West Hartford, Conn. Designed primarily for use in making tool depth and diameter settings, this comparator has the added advantage of being capable of checking tool runout and the cutting edge condition of any type of cutting tool, whether for numerical or manually controlled machines. By assuring correct tool setting and proper condition of cutting edges, the comparator will materially increase production and reduce work spoilage.

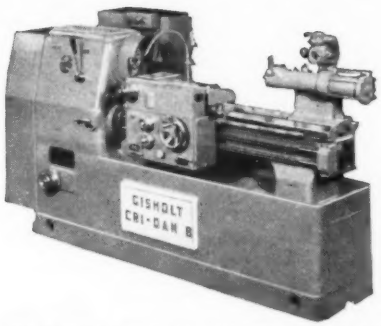
This optical tool-setting comparator can handle any type of tool shank—straight or tapered—merely by utilizing an interchangeable adapter. It is, in effect, a combination comparator and direct tool-setting device, using a set of reliable gage-blocks and end measures for even inch settings. Increments of an inch are set by a superaccurate micrometer head. To set the comparator, the gage-blocks and/or end measures equal to the nearest inch of length and diameter desired are placed in ground and lapped vees. Tool-print positioning is then observed through the microscope. Exact positioning is made possible by fine micrometer adjustments.

The comparator is sturdily constructed to maintain its high initial accuracy—reading to 0.0001 inch.

(Continued on page 159)

Tool-setting comparator developed by the Pratt & Whitney Co., Inc.

SOMEBODY *is doing it for* LESS



Gisholt CRI-DAN Model B Automatic Threading Lathe—Sets up in 8-15 minutes. Uses inexpensive single-point carbide tools to produce all types of internal and external threads: single- or multiple-start, coarse or fine, left- or right-hand, straight or tapered, standard or special form—in any material, including new high-tensile, hard alloys.

Optional accessories for the CRI-DAN B permit you to combine precision threading with tracing, turning, boring and facing cuts in one fast, automatic cycle. Other models are available. Call your Gisholt Representative or write for Catalog 1215.

While others are saving 30% to 80% with a new but proved threading technique, can you afford to stay with conventional methods?

With a Gisholt CRI-DAN High-Speed Threading Lathe, you can now use inexpensive single-point carbide tools to produce *quality* threads—simple or complex—*automatically*. A large number of progressive manufacturers (perhaps your toughest competitors) have found that the CRI-DAN technique cuts costs throughout the plant—with *direct* savings in initial costs, reduced threading times and tooling requirements—with *indirect* savings in tool inventory, materials-handling, floor space and planning.

Whether you're threading in lots of 6 or 600, the CRI-DAN technique will permit you to do it for less.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers® • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

For more data circle this page number on card at back of book

Landing gear manufacturer ups tool life with Gulfcut Heavy Duty Soluble Oil . . .

Menasco Manufacturing Company is a well-known builder of precision components for aircraft and missiles. In fact, most military and commercial jet aircraft use Menasco landing gears.

Menasco is continually searching for better and more economical cutting fluids. Recently, this outstanding firm switched to Gulfcut Heavy Duty Soluble Oil—a heavy duty water soluble coolant. Why? For two reasons: (1) versatility in many of the complex machining operations of high strength steels and (2) superior corrosion resistance.

This fine oil provided a forty percent increase in tool life in its first test—a figure that still holds! And because Gulfcut Heavy Duty Soluble Oil lasts longer, Menasco has been able to reduce coolant purchases by fifty percent.

"How can you put a dollar figure on so many benefits?" asks Mr. Stevens. "All we know is that savings on initial cost, better tool life, and reduced maintenance add up to a very healthy total."

If you've got a machining problem, try Gulfcut. And see for yourself why Gulf makes things run better! Just call a Gulf Sales Engineer at your nearest Gulf office. Or, write for detailed booklet.

Milling a slot 14 inches long by 2¾ inches deep by 2 inches wide in an AISI 4340 steel. It's only one of 450 operations in producing main motor yoke for a Bell helicopter. The coolant: Gulfcut Heavy Duty Soluble Oil.

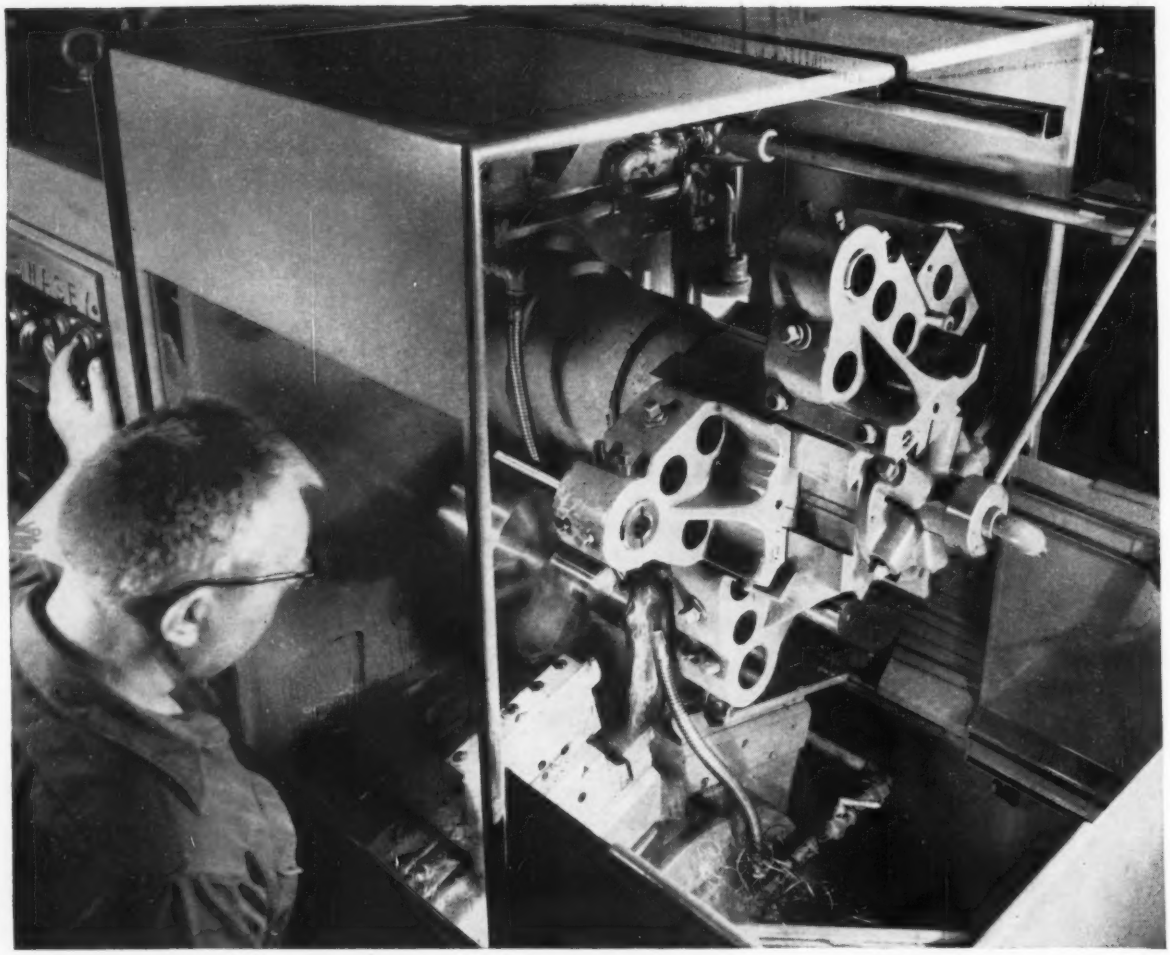
40%, cuts coolant costs 50%, GULF MAKES THINGS RUN BETTER!

GULF OIL CORPORATION
Dept. DM, Gulf Building
Houston 2, Texas

GULF

Final inspection. T. C. Stevens, left, Assistant Superintendent of Manufacturing, and Frank Mauro, Gulf Sales Engineer, inspect a main landing gear assembly for a B-58 jet.

SP-9992



Rigidity and accuracy built into this Warner & Swasey 2AC chucking automatic permit heavy metal removal while holding close tolerances. Twenty-one parts made from AISI 4340 and 4615/20 steels contribute resistance to stress and wear in critical areas.

Warner & Swasey uses two nickel alloy steels to give the 2AC built-in rigidity and accuracy

Variety of parts made from 4340 and 4615/20 for long-term resistance to impact and wear.

Here's where the Warner & Swasey Company relies on AISI 4340 and 4615/20 to help maintain the rigidity and accuracy for which this 2AC single spindle chucking automatic is fast becoming famous.

Four clutch plates, for example, are made of 4340. Through-hardened for these parts, this 1.85% nickel steel provides dimensional stability in heat-treatment and in high-temperature operation . . . in addition to vital resistance to shock-loading and torsion.

Shafts, guide blocks, studs, plungers, and clamp strips are just a few of the parts in the versatile 2AC made from another nickel alloy steel: AISI 4615/20. These components are carburized and hardened for wear-resistance to maintain accuracy throughout a long service life. And the *uniform* hard case is backed up by a strong, tough core that stands up to severe impact and torsional stresses.

This report is typical of the many coming in from manufacturers who have employed these two General Purpose Steels for a variety of machinery components.

Both these steels are readily available, right off the shelf at your local Steel Service Center. Together they give you a double-barreled way to cut costs and still satisfy almost all your alloy steel needs. Other nickel alloy steels, possessing special properties for specialized applications, are also widely available.

Consider nickel alloy steels for gears, shafts, bearings, and other machine parts you design, order, or use. And for engineering information to help you select the right material for the job you have in mind, just write to Inco.

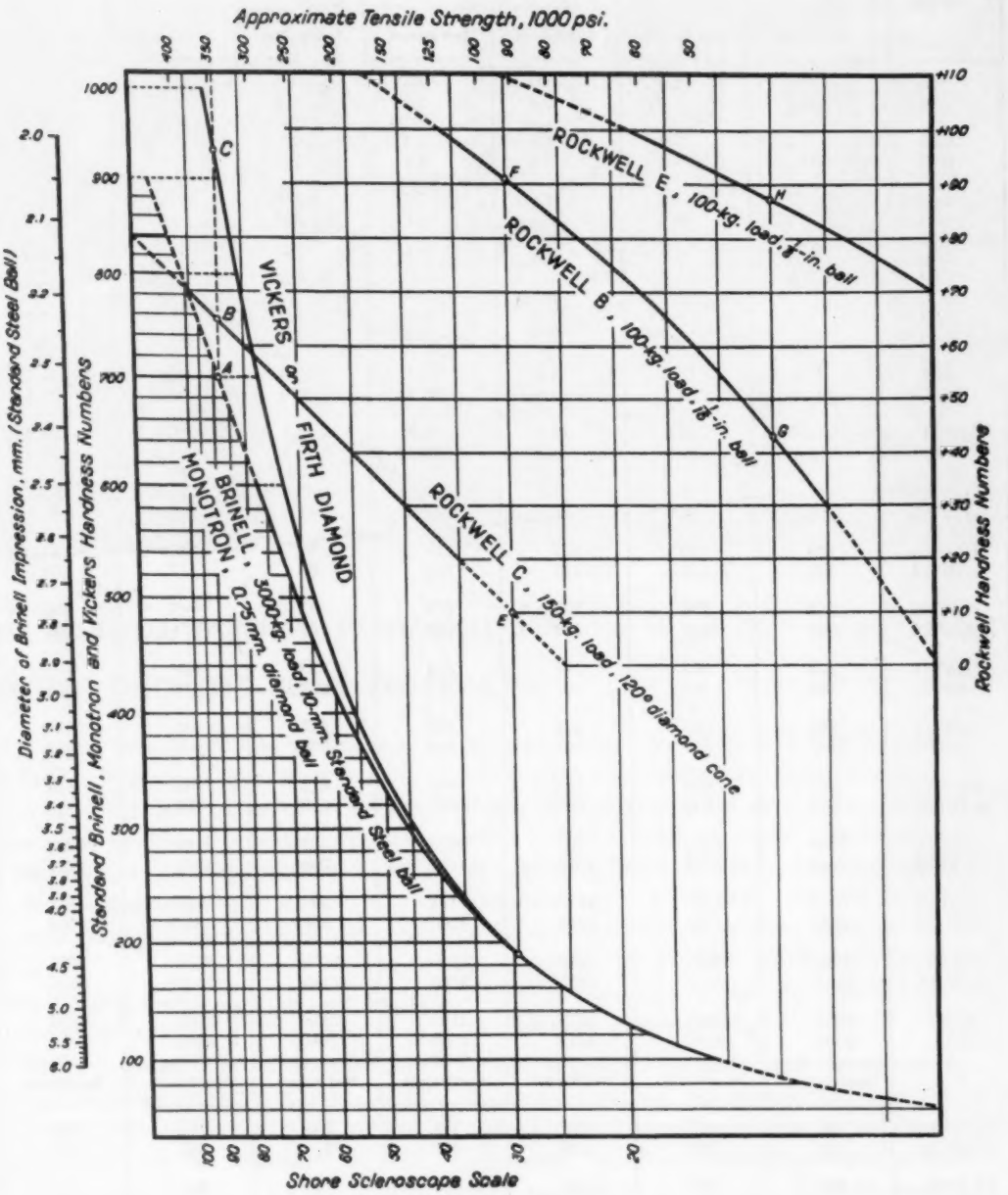
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N. Y.

INCO NICKEL

NICKEL MAKES STEEL PERFORM BETTER LONGER

HARDNESS CONVERSION

Approximate Relation between Hardness by Various Testing Systems and Tensile Strength of Carbon and Alloy Steels



Verticals represent equivalent hardness.

For instance: Brinell or Monotron 700 (point A) equals Rockwell C-65 (point B), equals Vickers 930 (point C), equals Scleroscope 89 (bottom scale), and about 340,000 psi tensile (top scale).

Again: Rockwell B-91 (point F) equals Rockwell C-10 (point E), equals Brinell, Monotron or Vickers 187 and Scleroscope 29, and has about 92,000 psi tensile strength.

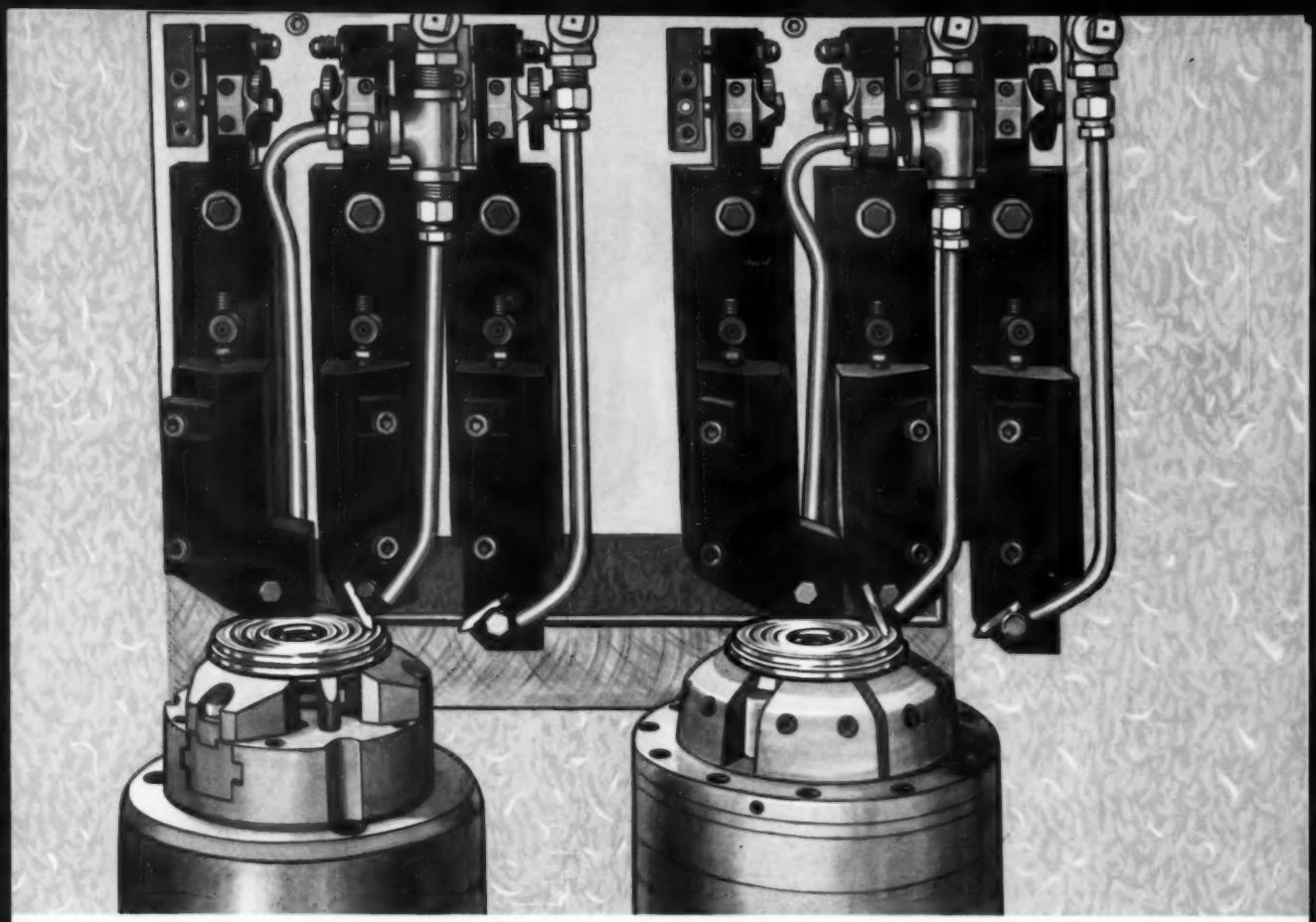
Finally, Rockwell B-43 (point G) equals Rockwell E-87 (point H). Chart based on data from Westinghouse Research Laboratories, Bureau of Standards, and the ASM Metals Handbook.

Courtesy of Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa.

SUGGESTED MAXIMUM TORQUE VALUES FOR FASTENERS OF DIFFERENT MATERIALS

Bolt Size	Low-Carbon Steel	18-8 Stainless Steel	Brass	Silicon Bronze	2457-4 Aluminum	316 Stainless Steel	Monel
	Inch-Pounds	Inch-Pounds	Inch-Pounds	Inch-Pounds	Inch-Pounds	Inch-Pounds	Inch-Pounds
2-56	2.2	2.5	2.0	2.3	1.4	2.6	2.5
2-64	2.7	3.0	2.5	2.8	1.7	3.2	3.1
3-48	3.5	3.9	3.2	3.6	2.1	4.0	4.0
3-56	4.0	4.4	3.6	4.1	2.4	4.6	4.5
4-40	4.7	5.2	4.3	4.8	2.9	5.5	5.3
4-48	5.9	6.6	5.4	6.1	3.6	6.9	6.7
5-40	6.9	7.7	6.3	7.1	4.2	8.1	7.8
5-44	8.5	9.4	7.7	8.7	5.1	9.8	9.6
6-32	8.7	9.6	7.9	8.9	5.3	10.1	9.8
6-40	10.9	12.1	9.9	11.2	6.6	12.7	12.3
8-32	17.8	19.8	16.2	18.4	10.8	20.7	20.2
8-36	19.8	22.0	18.0	20.4	12.0	23.0	22.4
10-24	20.8	22.8	18.6	21.2	13.8	23.8	25.9
10-32	29.7	31.7	25.9	29.3	19.2	33.1	34.9
1/4"-20	65.0	75.2	61.5	68.8	45.6	78.8	85.3
1/4"-28	90.0	94.0	77.0	87.0	57.0	99.0	106.0
5/16"-18	129	132	107	123	80	138	149
5/16"-24	139	142	116	131	86	147	160
3/8"-16	212	236	192	219	143	247	266
3/8"-24	232	259	212	240	157	271	294
7/16"-14	338	376	317	349	228	393	427
7/16"-20	361	400	327	371	242	418	451
1/2"-13	465	517	422	480	313	542	584
1/2"-20	487	541	443	502	328	565	613
9/16"-12	613	682	558	632	413	713	774
9/16"-18	668	752	615	697	456	787	855
5/8"-11	1000	1110	907	1030	715	1160	1330
5/8"-18	1140	1244	1016	1154	798	1301	1482
3/4"-10	1259	1530	1249	1416	980	1582	1832
3/4"-16	1230	1490	1220	1382	958	1558	1790
7/8"-9	1919	2328	1905	2140	1495	2430	2775
7/8"-14	1911	2318	1895	2130	1490	2420	2755
1"-8	2832	3440	2815	3185	2205	3595	4130
1"-14	2562	3110	2545	2885	1995	3250	3730
	Foot-Pounds	Foot-Pounds	Foot-Pounds	Foot-Pounds	Foot-Pounds	Foot-Pounds	Foot-Pounds
1 1/8"-7	340	413	337	383	265	432	499
1 1/8"-12	322	390	318	361	251	408	470
1 1/4"-7	432	523	428	485	336	546	627
1 1/4"-12	396	480	394	447	308	504	575
1 1/2"-6	732	888	727	822	570	930	1064
1 1/2"-12	579	703	575	651	450	732	840

Courtesy of Industrial Fasteners Institute, 1517 Terminal Tower, Cleveland 13, Ohio



New Britain's new concept for contour turning and boring

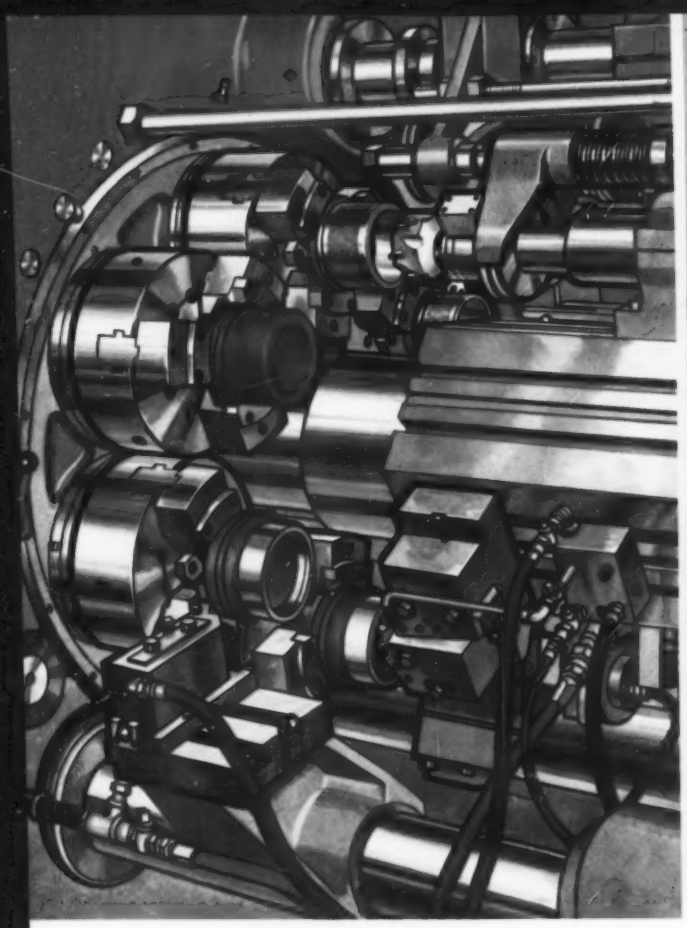
Beyond a certain point, continued refinement of existing designs in machine tools ceases to make an appreciable contribution to performance. Thus in designing our New Series of Vertical Precision Boring Machines, we have incorporated several completely new design concepts to provide improved performance and greatly increase over-all usefulness.

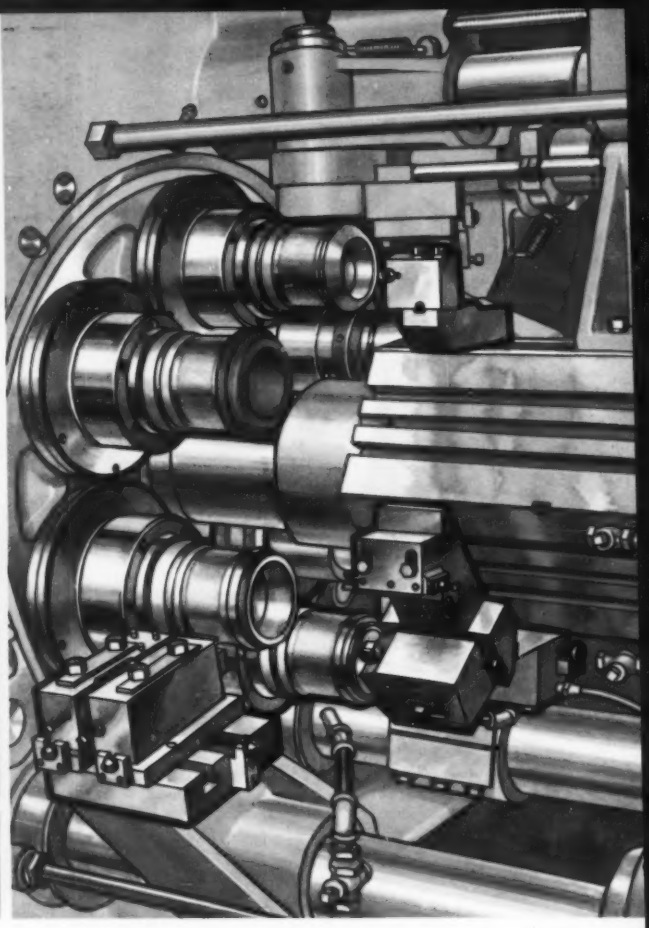
For the first time machines of this type can be used as building block units. Their clean-sided design permits any number of self-contained machines, each with one or more spindles, to be arranged side by side and operated as a single unit. They also may be operated with equal efficiency as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine.

In order to take the fullest advantage of the precision inherent in cam control, long linkages between cams and slides have been eliminated. A pair of cams is mounted on a common shaft which is carried *within the vertical slide*. Since all slide actuating forces are contained in the vertical slide, both cams are directly adjacent to the slides they control and no outside forces are imposed on the slide ways. The result is maximum rigidity for heavy cuts coupled with extreme accuracy for close tolerance work.

This unique and eminently workable approach to contour turning and boring results in the highest order of accuracy on even the most complex pieces. Your New Britain Representative can give you details on the nine different models available in this series. For catalog material, write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut





New Britain . . .
still the best Chucker you can buy

We're not unhappy about the fact that for years, in many plants, the name New Britain has been synonymous with chuckers. New Britain Chuckers have turned out literally millions of pieces of work for practically every major industry in the world. This is less important to the prospective buyer of one of these machines, however, than the capabilities of these machines today. How do they stack up against other chuckers or even other types of machines capable of doing similar work? Pretty well, we think.

New Britain's open-end design still can't be beat for unlimited accessibility to the tooling area. This same wide-open feature makes it doubly more practical to adapt these machines to automatic loading and unloading.

The unusual combination of longitudinal and transverse forming motions is another unbeatable New Britain feature. The massive forming arms on New Britain Chuckers allow heavier cuts and cuts of much greater complexity. This ability to do more work can eliminate the need for second operation machines in many instances. For really complex work, two chuckers set up side by side, as shown here, each doing one side of the piece, can smooth the way for high production. Less complicated work can be set up to perform both sides of the same piece on a single machine.

These massive machines provide the tooling combinations, spindle speeds and power to perform the widest possible variety of work. Their basic design will stay new for years to come, continuing to provide profitable operation. You may know New Britain Chuckers, but you may not be fully aware of the improved series presently being offered. Why not call your New Britain Representative or contact us at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut

Cross-slides operate on ground and lapped ball ways. High accuracy is feasible, since settings are made through a high-powered microscope. The headstock spindle rotates freely on precision ball bearings. Maximum depth and diameter capacities are 12 and 6 inches, respectively.

Circle 582 on Reader's Service Card

Johansson Heavy-Duty Radial Drilling Machine

A heavy-duty precision radial drilling machine has recently been developed by the I. O. Johansson Co., Skokie, Ill., to fill the gap between sensitive upright drills and a large radial drill. Unlike conventional radial drills where the arm moves up and down, the Johansson radial-drill column is supported in a housing that provides longer bearing support and inherent added rigidity. The radial arm, or ram, can be had in a 3- or 4-foot length. It swings through 360 degrees for positioning at any location over the 20- by 40-inch work-table at the front of the machine, or over the 25- by 42-inch work platform at the rear of the machine when taller or heavier work-pieces are to be drilled.

This radial drill is built with column and ram power locks. When the operator locates the drill, rotation of the column and movement of the ram are both locked simultaneously and instantly by pressing a button that actuates the electromechanical lock. With the column locked from rotating, it can be moved up or down 12 inches in the column housing, giving a 54-inch maximum or a 6-inch minimum distance from spindle to work surface, without losing the drill location. Vertical movement of column is accomplished simply by turning a switch which actuates the column power elevation mechanism. This exclusive patent-applied-for feature allows the operator to do hole drilling up to 22 inches deep.

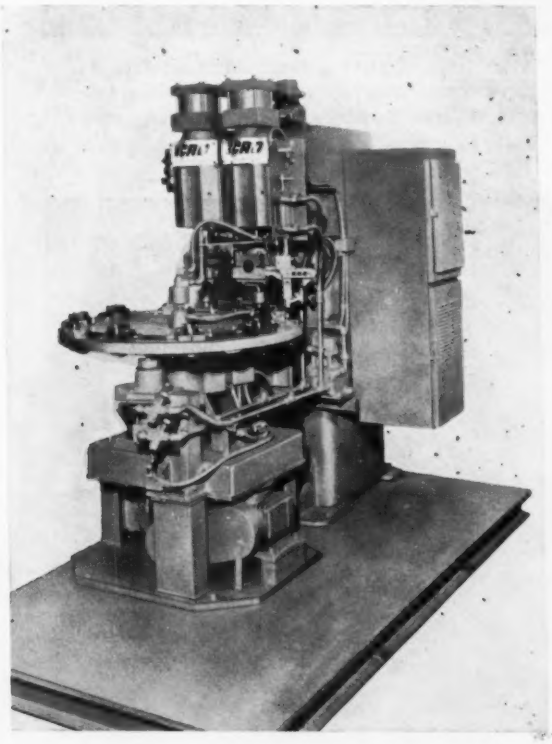
The gear drive provides sixteen spindle speeds in four optional ranges from 34 to 1640 rpm. Ball type antifriction bearings are used throughout the head, and all gears are of heat-treated alloy steel and have shaved teeth. A built-in oil pump lubricates the entire speed train, and the feed train operates in an oil bath. The feed mechanism is infinitely variable from 0 to 12 ipm at any spindle speed, and can be set at any time, even when operating and under load. The feed clutch, of electromechanical construction, disengages automatically when the spindle reaches preset depth, and the spindle returns to top position. A safety clutch prevents overloading of the feed mechanism.

Circle 583 on Readers' Service Card

Acromatic Dial-Indexing Welding Machine

The Acro Welder Mfg. Co., Milwaukee, Wis., has announced an automatic dial-indexing welding machine equipped for rapid subassembly work. This machine is shown in the illustration ready for manual loading and pilot production of ball-bearing conveyor-

Radial drilling machine made by I. O. Johansson Co.



Dial-indexing welder built by Acro Welder Mfg. Co.

MICROHONED* High Pressure

After years of service, the Micromatic Hydrohoner continues to produce bores to precision tolerances. Interlocked controls provide an automatic Microhoning cycle.

Bores are located in Microhoning position by this two-station fixture. It is of the disappearing locating plug type. When all bores are Microhoned, the fixture is indexed to bring another barrel into position and the finished barrel is swung to the load-unload station.

High pressure hydraulic axial piston pumps produced by Dynex Incorporated (Pewaukee, Wisconsin) achieve an overall efficiency of 97%. It is this high efficiency that makes the "Split-Flow" feature of Dynex pumps particularly effective. Characterized by independent, multiple circuitry that uses a single pumping unit, "Split-Flow" is designed to resolve problems in synchronizing feeds and speeds in circuits with unequal loads, or to provide auxiliary circuit requirements. As many separate circuits can be provided as there are pistons.

MICROHONING Provides Precision Bores

To hold the critical running seal between barrel bore and piston, it is mandatory that bore size, geometry, straightness and finish are consistently held to required tolerances. Therefore, Microhoning is specified to generate these prime final characteristics that are essential in attaining high pump efficiency. Emphasizing the importance of the seal is the fact that larger high pressure Dynex pumps must consistently hold a pressure of 6,000 psi.

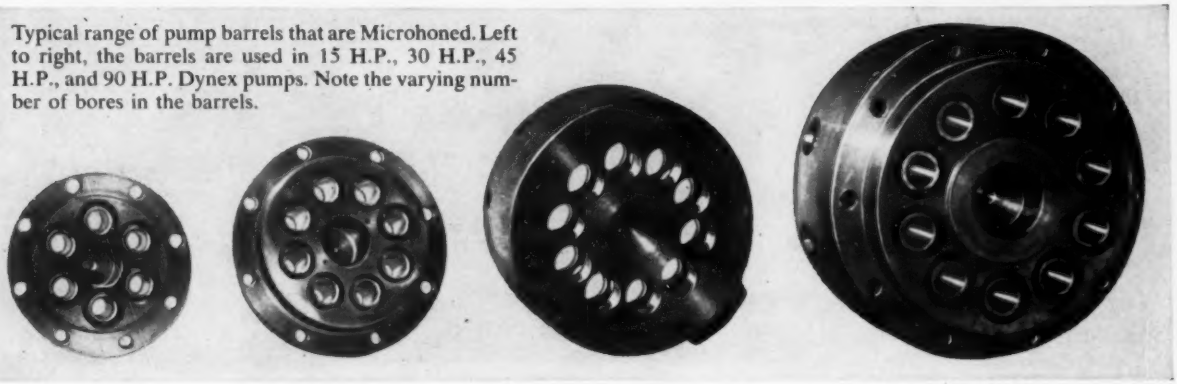
MICROHONING Eliminates Scrap Problem

Significantly, the barrels are the most expensive and critical pump parts to manufacture. If just one of the several bores in each barrel is out of tolerance, the whole barrel is scrapped. Previously used methods involved burnishing and proved unsatisfactory in providing consistent size and geometry, or in maintaining production volume. A rejection or scrap rate of 10% was not unusual. Microhoning has now eliminated the scrap problem by consistently generating bores within the specified tolerances for size, roundness, straightness and surface finish.

*Registered U.S. Pat. Off.

Dynex Pumps Reach 97% Efficiency

Typical range of pump barrels that are Microhoned. Left to right, the barrels are used in 15 H.P., 30 H.P., 45 H.P., and 90 H.P. Dynex pumps. Note the varying number of bores in the barrels.



MICROHONING Assures Production Efficiency

Depending on pump size (1 to 90 H.P. or more) and design, there are six, eight or ten bores in each barrel and Microhoned bores range in diameter from .5936" to .8138" and are approximately 3⅛" long. Also, plans are underway to Microhone another barrel with bores .965" in diameter and 3-3/32" long.

Preceding the Microhoning operation, the bores in the soft steel barrels are reamed and a finish of 60 to 65 microinches (rms) is obtained. Microhoning then removes an average of .0025" stock from the bore diameter in a time cycle of about 50 seconds.

An automatic sizing device (Gage Ring Microsize) controls the bore size within the .0002" tolerance. Also, with Microhoning, the roundness and straightness of the bore are held to a .0001" tolerance, and a surface finish of 10 microinches (rms) is consistently generated.

The use of Microcool "97" cutting fluid permits selecting a Microhoning abrasive coarse enough to cut effectively and still provide the required relatively fine finish.

Because Microhoning assures barrel bores that are consistently held to specified tolerances, the assembly of pistons and barrel is facilitated. Assembly time thus saved is considered by Dynex engineers to be a bonus benefit derived from the Microhoning process.

For further information on MICROHONING, please write to:

DYNEX Plans Expanding the Use of MICROHONING to Other Applications

As a part of a Dynex program to broaden the use of Microhoning, the bores in brake valve housings are scheduled as the next application for this efficient process. Currently, the processing problem is slow production and high scrap rate. Unless a highly skilled operator is used regularly on present method of manual honing, rejects run as high as 50%.

The interrupted bore, in which the spool valve operates, is 1.000" in diameter and 1¼" long; it has a counterbored throat about 1⅞" deep. With proper fixturing and tooling, Microhoning will generate accuracy in this critical bore within the required overall tolerance of .0004", while controlling the surface finish to the specified 32 microinches (rms).

Cutaway view of brake valve housing with spool in position. Open view of housing shows bore surface (with two close, parallel grooves) that is to be Microhoned.

PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

For more data circle this page number on card at back of book

wheel assemblies. Two 75-kva, 2300-pound electrode-force press welding heads in a series welding circuit projection-weld two wheels.

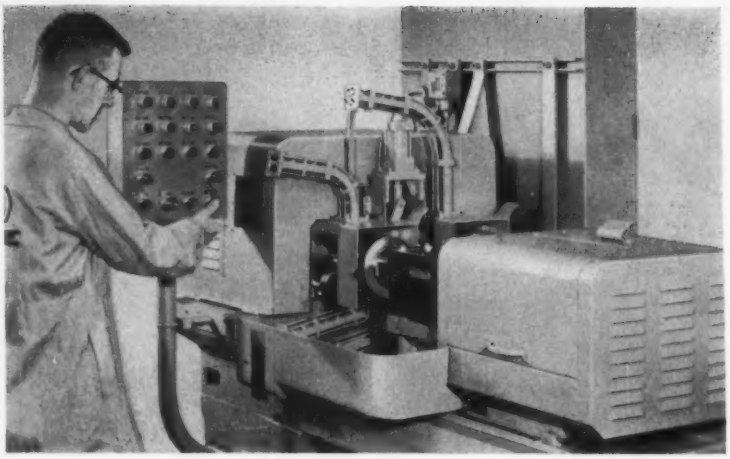
Not shown are three hopper-orientating bowl, track, and transfer units for automatically loading the six balls and cone and cup comprising each wheel assembly.

Circle 584 on Readers' Service Card

Ex-Cell-O Automated Boring Machine for Automotive Pinion Blanks

An automated precision boring machine produced by the Ex-Cell-O Corporation, Detroit, Mich., finish-bores the internal diameter of automotive transmission planet-carrier pinion blanks at the rate of nearly 400 parts per hour. Once initiated, the operation is automatic and continuous. Fast-acting air cylinders operate the work-handling mechanism. Gravity-fed parts are precisely and quickly located and clamped. Boring is completed in nine seconds. The finished parts are released and dropped into a discharge chute as the next cycle commences.

Accuracy of bore size is held to within 0.0006 inch, while the bore is held square to the faces of the part within 0.0003 inch. A quill having a micrometer adjustment facilitates rapid and accurate tool setting. An automatic quill movement permits the tool to clear the work to eliminate drawback lines.



Ex-Cell-O automated precision boring machine for processing automotive part

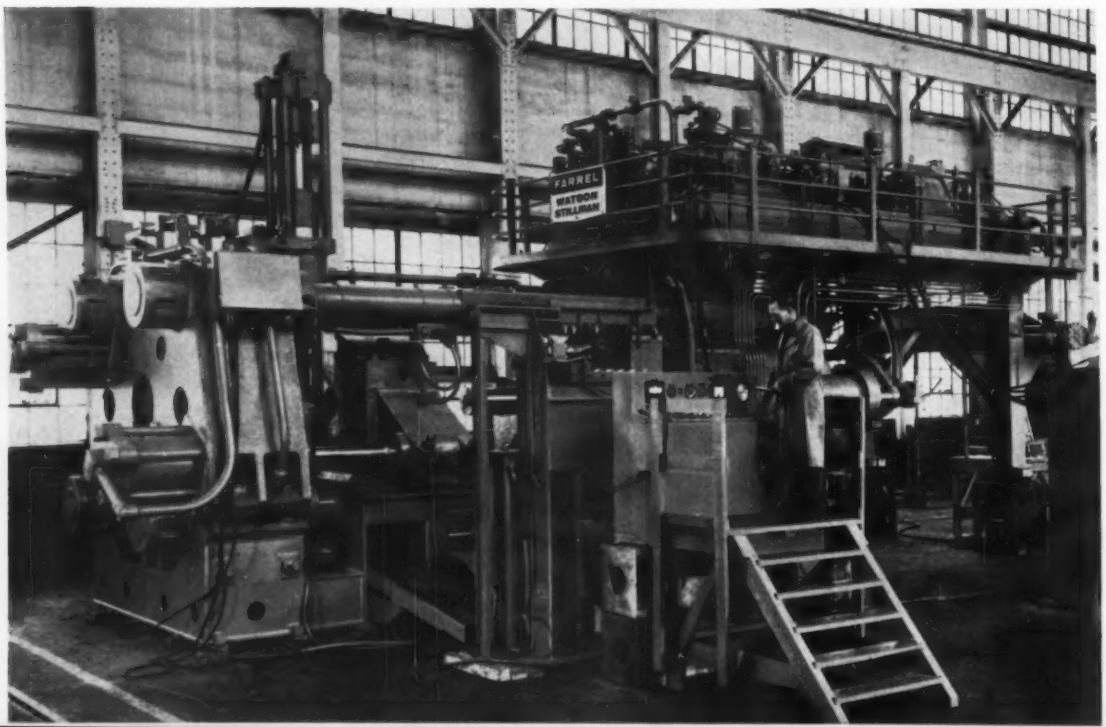
Circle 585 on Readers' Service Card

Hydraulic Self-Contained Aluminum Extrusion Press

The Watson-Stillman Press Division, Farrel-Birmingham Co., Inc., Rochester, N. Y., has completed another 3300-ton hydraulic self-contained aluminum extrusion press which operates at a pressure of 2750 psi. This huge press, designed and manufactured at the company's Rochester plant, will be installed in India. Included with the press are two detwisting type stretchers in capacities of 100 and 25 tons and a 100-ton straightening press.

The press length, without run-out table, is 42 feet 7 inches. Over-all height above the floor line is 17 feet, and the depth be-

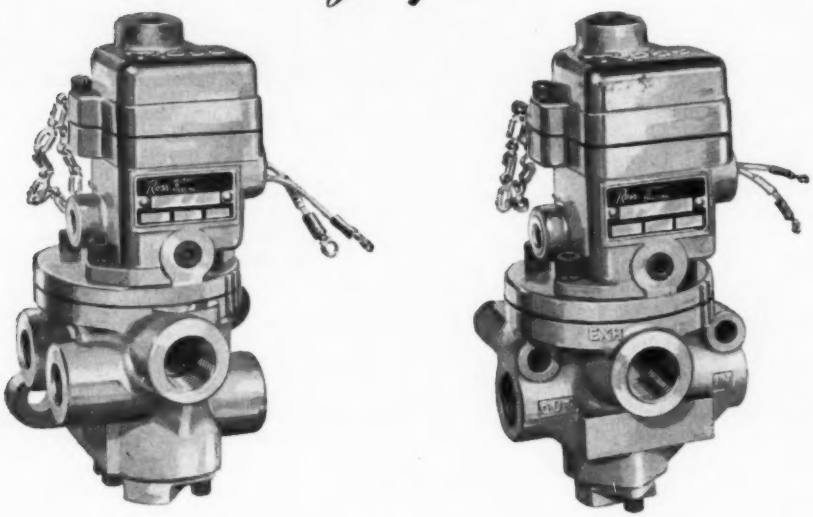
Farrel-Watson-Stillman 3300-ton hydraulic self-contained aluminum extrusion press



THANK YOU . . .
for your enthusiastic response to this announcement. Because it has been viewed as an important advance in valve development, we reprint this news for those who missed its first appearance.

Ross

Proudly presents



THE NEW "HEADLINE" SERIES

A complete new series of inline valves, sizes one-quarter inch through one and one-half inch, straightway, 3-way and 4-way. These valves, size for size, will operate faster, longer, and provide greater capacity than any other valves we have been able to find.

When the price, quality and performance and Ross reputation are taken together in evaluating this series, it represents probably the best valve value available today. Before you specify any valve after today, you owe it to yourself to look into the "Headline" series. Write for full information.

Ross OPERATING VALVE COMPANY
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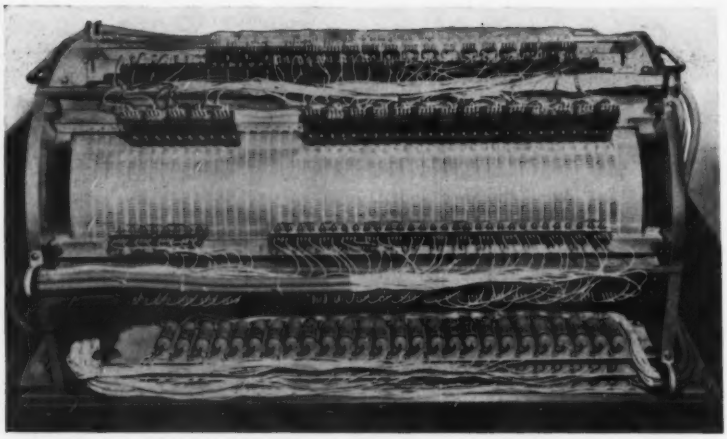
low the floor line is 3 feet 4 1/4 inches. Maximum width is 20 feet 7 inches, and the approximate weight, 225 tons. Extrusion speed at 3300 tons is 43 ipm, and 52 ipm at 2750 tons. The press has a maximum capacity for round billet 14 inches in diameter and 30 inches in length. Dry cycle time is approximately 23.30 seconds.

Circle 586 on Readers' Service Card



Dynastat magnetic memory drum that presents stored information independently of rotational speed

Dynastat Magnetic Memory Drum for Program Control

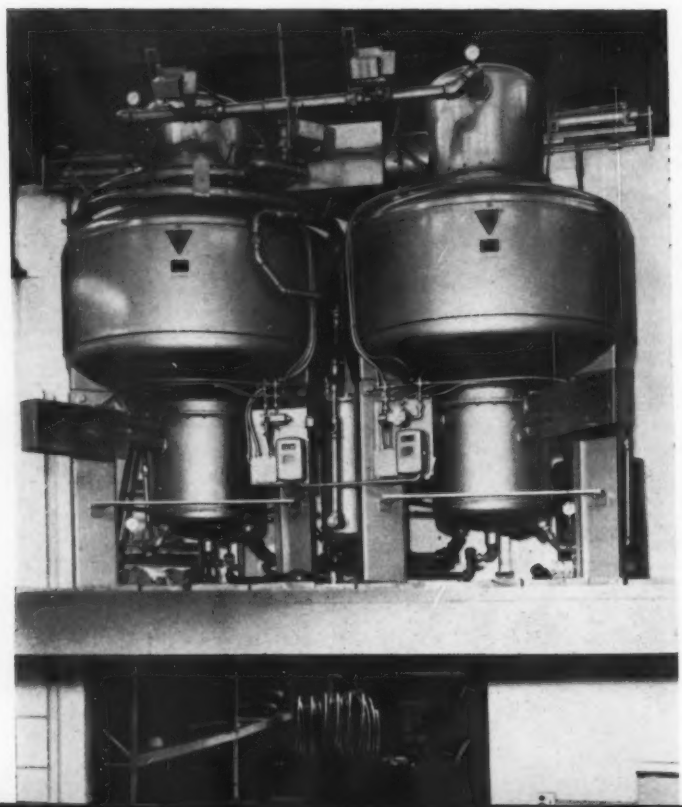
A magnetic memory drum particularly suited to the program control of multiple-cutting machine operations has been introduced by Consolidated Controls Corporation, Bethel, Conn. A feature of this memory drum is its ability to present recorded information regardless of whether it is in motion or stationary. Thus, it can present cutting coordinates on a step-by-step basis, remaining stationary while the associated machine tool completes a cut. In the stationary condition it continuously presents information for comparison and control. At the end of a cut, the drum steps to its next position, corresponding to the end of the next cut, and signals the new coordinates to the machine. This process continues until the machining operation is completed, when the drum cycles rapidly back to its starting position, ready to begin a new sequence.

Instructions for a particular machining sequence are recorded during the initial setup of the machine. Coordinates for each operation are recorded as a series of parallel binary code words on sequential steps of the drum. The output from this Dynastat drum, as it is called, serves to eliminate the need for sensitive amplifiers.

The size of the drum varies with the quantity of information to be recorded. As an example, a ten-channel, 2000-bit drum (200 discrete segments per channel), including heads, electronic and terminal board, measures 26 inches in length by 14 inches in height and 14 inches in width.

Circle 587 on Readers' Service Card

This unique installation of Vic Mfg. Co.'s solvent vapor-recovery system at a plating company utilizes an overhead platform with no sacrifice of working area



Vapor-Recovery System Reduces Solvent Loss and Health Hazards

The loss of solvent through evaporation of vapors has long been a source of several related problems in the metals-cleaning field. Not only has loss by evaporation been a substantial expense to firms using solvent, but vapors have posed hazards to health. Side effects from airborne vapors sometimes cause coating and finishing problems. In some cases, where ventilation is inadequate, solvent vapors have caused corrosion on the surfaces of manufactured and finished metal parts. Vapors have also been shown to affect painting operations, sometimes causing cloudy or uneven organic finishes.

A process for the recovery of

56

S&F GEAR TESTERS CAN'T BE WRONG!

AND THEY NEVER ARE— AT ECLIPSE-PIONEER

Division of Bendix Aviation Corp., Teterboro, N. J.

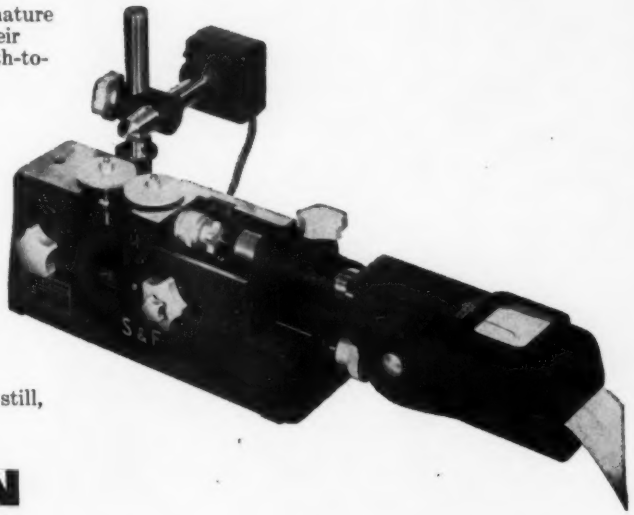
Turning out Precision Class 3 Gears is almost second nature to Eclipse-Pioneer. These are the gears that go into their famous directional gyros for aircraft and missiles. Tooth-to-tooth error, .0002". Total composite error, .0003".

The first S & F Tester bought by Eclipse-Pioneer four years ago told them what they wanted: no other gear checker was so accurate, so easy to use.

So they kept buying them. For floor after floor. Section after section. Year after year. Now, 56 S & F Testers act as guardians of precision all over the plant—assurance that Eclipse-Pioneer gears really hold to the tolerances called for.

Would *you* like to be assured that the gears you make—or buy—are as accurate as they're supposed to be? Check them on an S & F—guaranteed to repeat within .00001"—as 359 plants now do.

Ask us to send you the name of a nearby user. Better still, may we demonstrate the S & F for you?



KO KURT ORBAN
COMPANY, INC.
42 Exchange Place, Jersey City 2, N. J.

For more data circle this page number on card at back of book

usable solvent from vapors, usually lost during degreasing and cleaning operations, has been developed by the Industrial Division of Vic Mfg. Co., Minneapolis, Minn. Thoroughly field-tested on actual installations over a period of three years, a line of industrial vapor adsorbers has often cut solvent costs by more than 50 per cent, and has removed a health hazard as well, preventing the escape of undesirable solvent vapors to the atmosphere of adjacent working areas.

The company's vapor-recovery system captures solvent evaporating during degreasing and cleaning operations by ducting it into a specially designed chamber incorporating a bed of activated carbon. It returns clear, usable solvent after a steaming operation and decantering process have been completed.

Circle 588 on Readers' Service Card

Duplex Precision Half-Mill for Rotary Milling

A duplex vertical precision Half-Mill has been developed for high-production rotary milling operations by the U.S. Burke Machine Tool Co., Cincinnati, Ohio. This compact unit is designed to mill circular grooves to preplanned tapered depths in the production of pump units for automatic transmissions and is now in operation in the plant of a leading automobile manufacturer. Two parts are automatically processed at one time. The operator simply places the parts on the two tables and presses the start button. Air-actuated elevator type clamps hold the work-pieces in the centers of independently powered rotary tables. The tables rise until the parts hit locators and start the automatic cycle. Release at completion of cycle is automatic after the clamp descends with the part.

The power-feed rotary tables revolve at the rate of 2 rpm. As each part rotates, the cutter—a carbide end mill—rises and falls, thereby milling oil-grooves, the critical depth and contour of which are accurately controlled. A rise-and-fall cam, bolted to the periphery of each rotary table, assures the accuracy of the preplanned precision operation. An air cylinder forces the quill down so that a roller guide attached to the quill stays in constant contact with the cam. A brush with drip oiler precedes the cam follower to keep the cam surface clean.

The motors that drive the speed reducers (which in turn are directly connected to the rotary tables) are mounted on either side of the Half-Mill. Both spindles are powered by independent motors with flat belt drives that give a fixed speed of 6000 rpm.

Circle 589 on Readers' Service Card

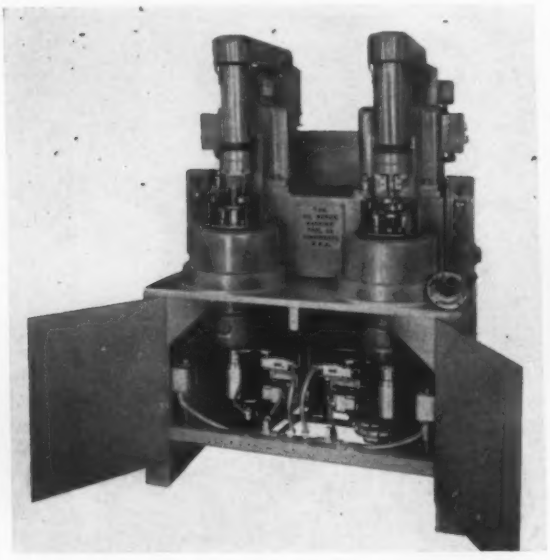
Multiple Punch for Beam Web and Flange Punching

Webs and flanges of beams in sizes ranging from 3 to 36 inches can be punched on a line of all-steel closed-frame multiple punches introduced by Thomas Machine Mfg. Co., Pittsburgh, Pa. These machines, offered in 150-, 225- and 300-ton capacities, also will accommodate angles, channels, tees, and wide-plate punching work. Standard machines are furnished with a single line of punching tools, but may be arranged for double-line work.

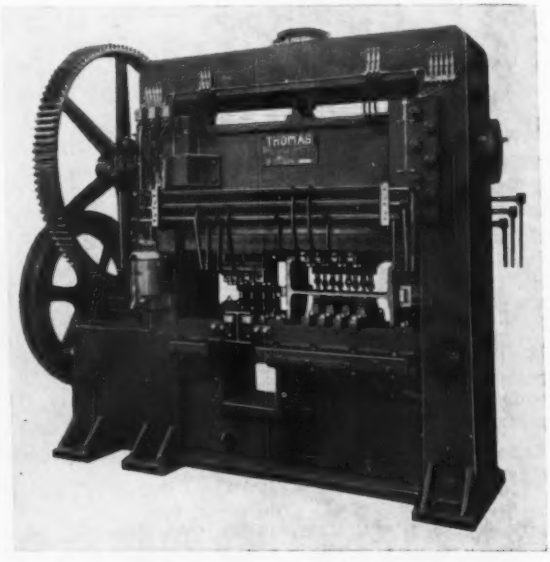
The compact design of the machines features rugged welded-steel construction, air-electric clutch operation, air counterbalance, antifriction bearings, formica ram guides, and ductile-iron gears. Centralized lubrication and multiple-lever gag controls are optional extras. Maximum production efficiency is obtained by using these punching machines with Thomas spacing tables.

Circle 590 on Readers' Service Card

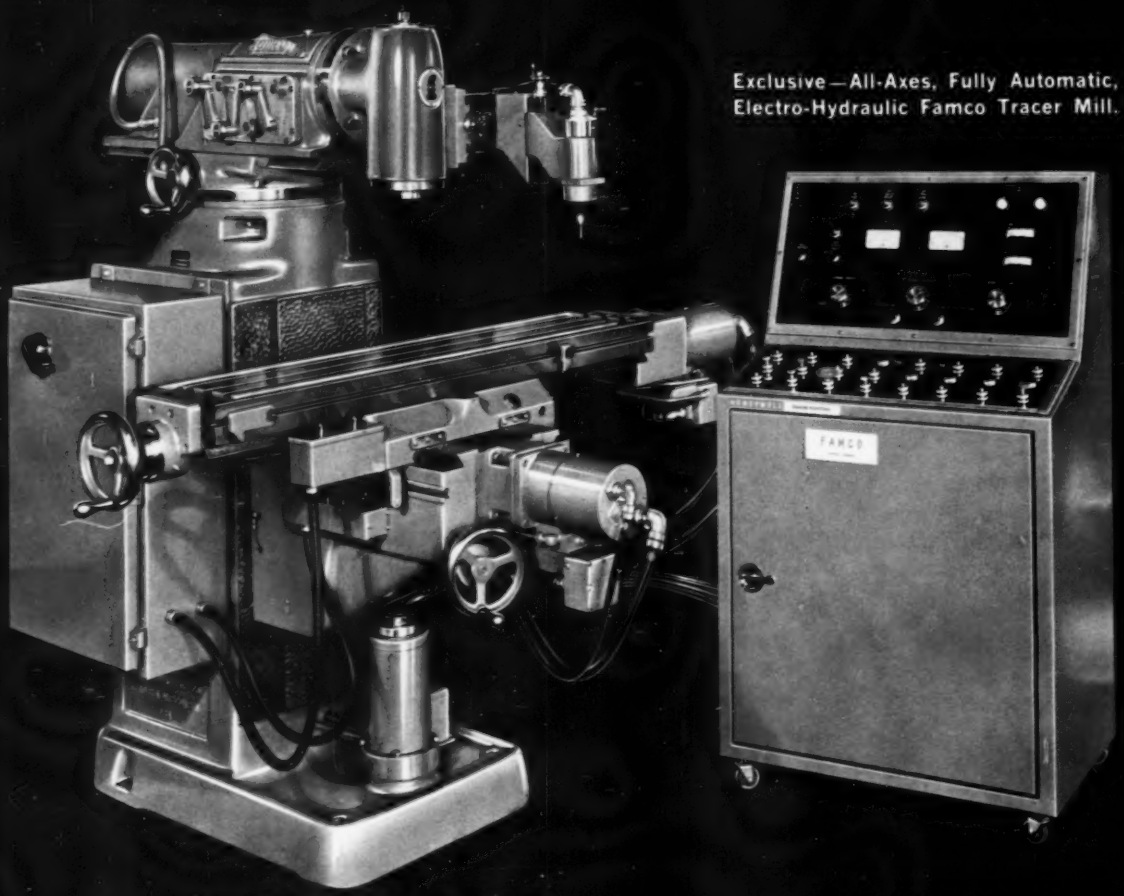
(This section continued on page 169)



Duplex U.S. Burke Half-Mill for milling circular grooves



Thomas multiple-punching machine for I-beam work



Exclusive—All-Axes, Fully Automatic, Electro-Hydraulic Famco Tracer Mill.

RUN OR DIE

No other machine tool handles production runs of intricate parts—die and mold work, too—as speedily and efficiently as a Famco tracer mill. No other method can give you as great and as fast a return on your investment. Boastful? No! Users of Famco tracer mills are turning out 3, 5, 10 and even more pieces in the time formerly required to produce one.

Famco—with the most complete line of precision tracer mills—offers you the profitable solution for speedier production runs or die work, regardless of shape. See how Famco tracers can pay off for you. Just write and tell us your problem.

FAMCO MACHINE COMPANY

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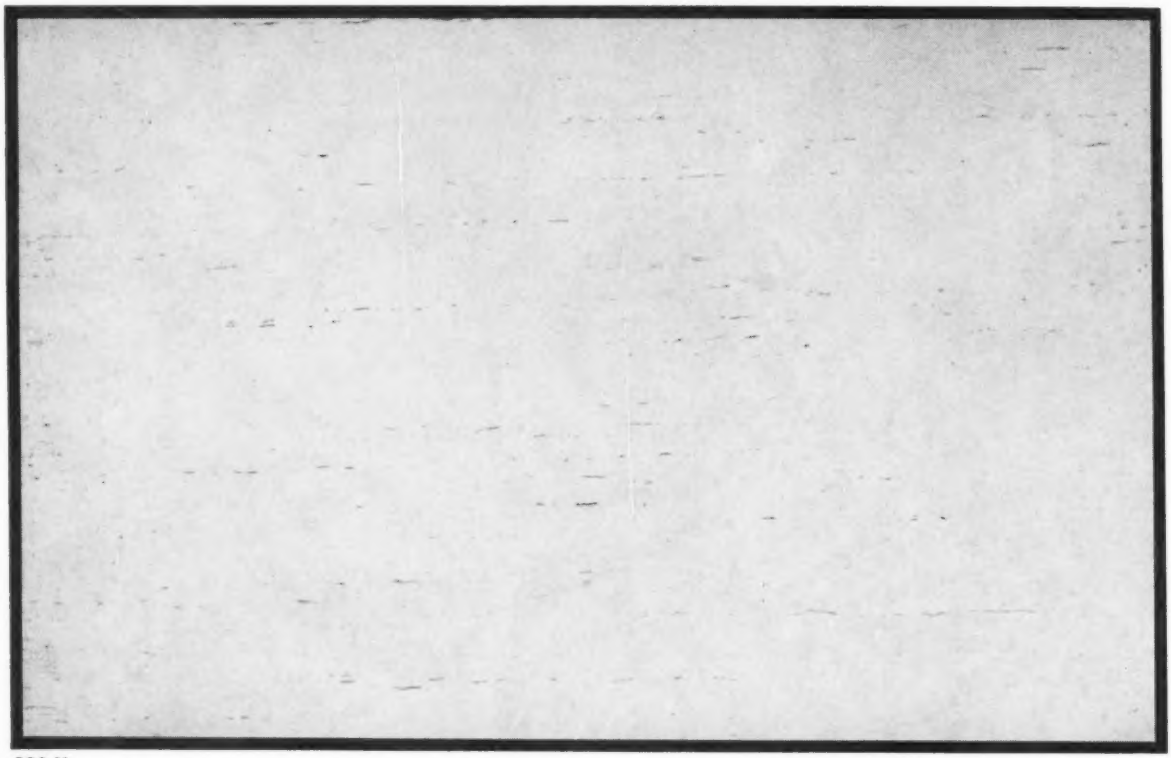
Products of Famco

Milling Machines—Presses: Air, Hydraulic, Foot, Power, Arbor—Squaring Shears—Band Saws

Why this steel costs less to machine...



100 X

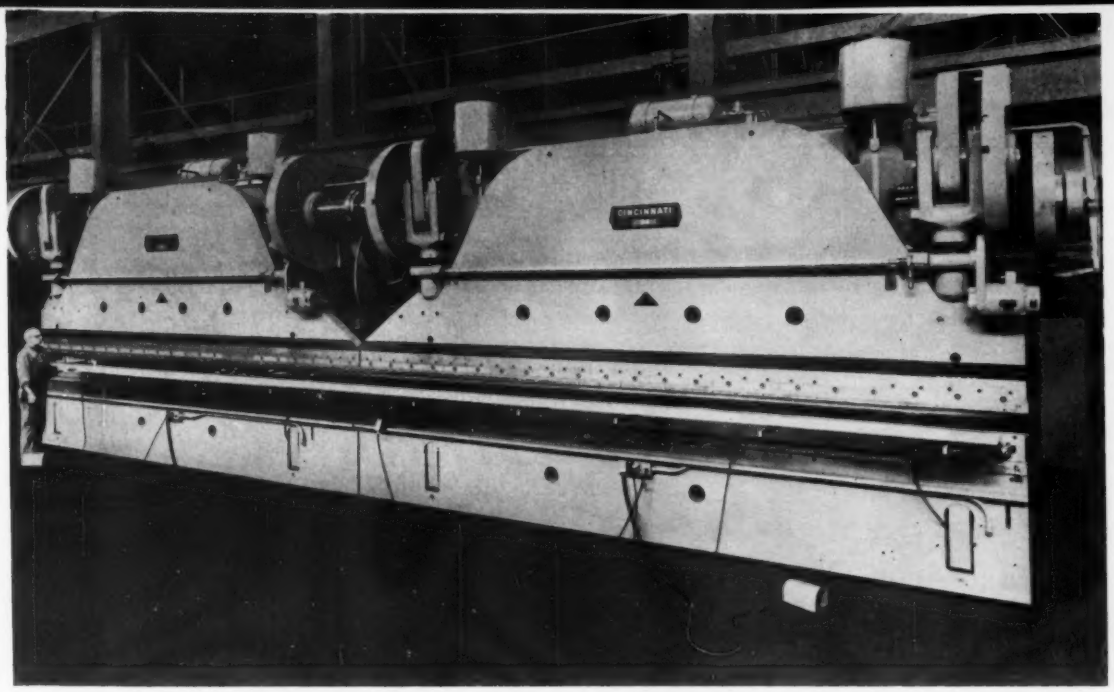
YOU'RE looking at a photomicrograph of Timken® steel that has been resulphurized to give better machinability. Those sulphides you see in the picture interrupt the chip flow, giving shorter chips and faster machine speeds.

And you get this better machinability without any sacrifice of surface quality or mechanical properties when you buy Timken resulphurized steels. Small amounts of carefully prepared sulphides are added to the molten steel under exact conditions of time and temperature. The result: Tubes or bars with good surface quality, good physical properties, and substantially improved machinability without the disadvantages sometimes found in free-machining steels. And when you buy Timken fine alloy steel, you're assured of uniformity from bar to bar, heat to heat, and order to order.

If you're looking for a way to reduce machining costs on parts made from seamless tubing, bar stock, or forgings, call your nearest Timken Company sales office. Timken resulphurized steels are available in most grades of alloy steel. ***When you buy Timken steel you get . . .*** *1) Quality that's uniform from heat to heat, bar to bar, order to order. 2) Service from the experts in specialty steels. 3) Over 40 years experience in solving tough steel problems.* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*

TIMKEN® *Fine Alloy* STEEL

TIMKEN ALLOY STEEL AND SEAMLESS STEEL TUBING ARE AVAILABLE FROM STEEL SERVICE CENTERS IN 44 CITIES IN THE UNITED STATES



Cincinnati press brakes interlocked to give 44-foot die-length capacity

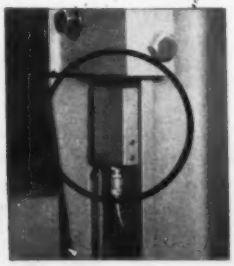
Two Cincinnati Press Brakes Interlocked to Provide 44-Foot Die-Length Capacity

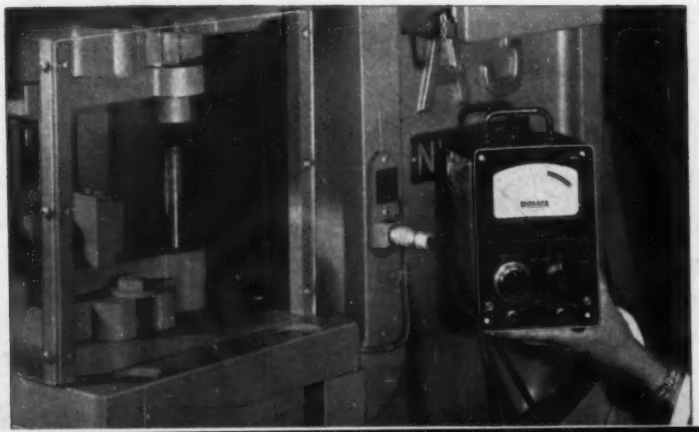
One of the longest mechanical press brakes ever built, which has an over-all die length of 44 feet, has been manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio. This metal-forming machine is composed of two Cincinnati 34 series 16-foot press brakes that are coupled together for either synchronized or individual operation. It will form 3/8-inch thick mild-steel plate 44 feet long.

Specifications of the individual machines are: distance between housings, 16 feet 6 inches; stroke, 6 inches; throat, 26 inches; die space, 16 inches; and extension of bed and ram, 24 inches. The bed and ram are planed and drilled for 7 3/4-inch high angle-brackets, and there is a two-speed attachment that is interlocked for either individual or synchronized operation. An air-electric clutch provides automatic stop and non-repeat control. Equipment includes automatic pressure lubrication and air counterbalances to the ram.

Circle 591 on Readers' Service Card

(Top left) Niagara Load Monitor control unit. (Top right) Pickup for unit shown at left mounted on frame of straight-side press. (Bottom) Close-up of Niagara Tonmeter plugged into pickup on open-back inclinable press





Electronic Instruments for Measuring Press Loads

Two electronic precision instruments designed to safeguard presses and dies against damage during production runs are now available from Niagara Machine & Tool Works, Buffalo, N. Y. The Niagara Load Monitor (Model 112) is designed for continuous measurement of all press loads on a given press. It responds instantly and accurately regardless of press speed. Consisting of a control unit located conveniently near the press, plus two or four pickups mounted permanently on press frame or tie-rods, the Load Monitor registers loads from 0 to 140 per cent of press capacity. To

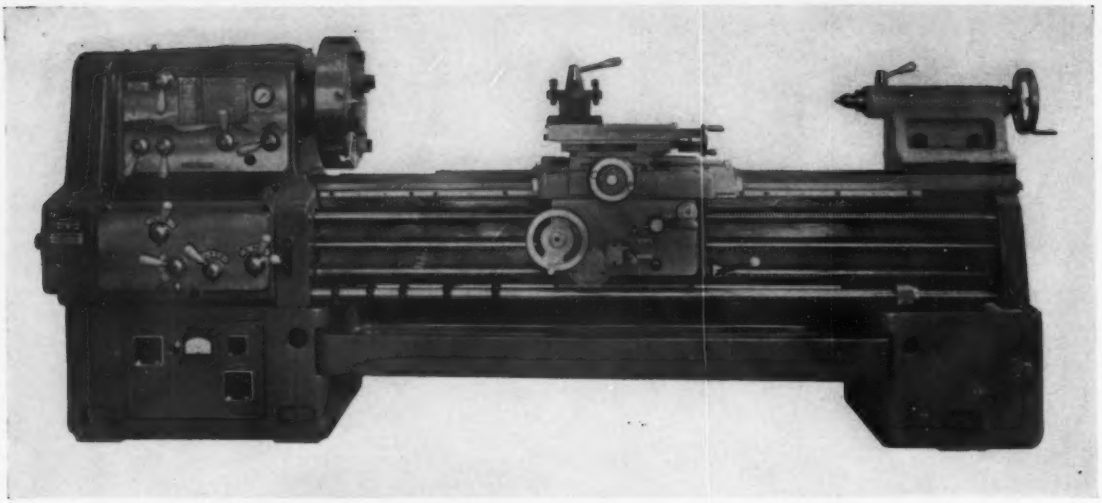


Fig. 1. Improved model Clover lathe announced by Hermes Machine Tool Co., Inc.

prevent overload repeats, it is equipped with a special tripping circuit which disengages the clutch when the preselected percentage of press capacity is reached. It can also be arranged to actuate a warning signal. All adjustment controls are key-locked to prevent tampering by unauthorized personnel. Because of their small size (4 by 2 inches by 1 inch) the pickups can be mounted well out of the way of die and feeding spaces.

The Niagara Tonmeter (Model 119) is a portable instrument designed to show the maximum load on a press during the operating cycle, as well as when die setting. To operate, the Tonmeter is plugged into pickups mounted on the frames of the press or presses to be checked. Like the Load Monitor, it responds instantly regardless of the press speed.

Because the battery-powered Tonmeter requires no electrical outlet and is easy to carry, one individual can check the "percentage of full load" on several presses in a matter of minutes. Setting the simple press-factor dial calibrates the meter for each press.

Circle 592 on Readers' Service Card

Clover Lathes and Caser Radial Drills

The Hermes Machine Tool Co., Inc., Long Island City, N. Y., has announced design changes in the line of Clover lathes, Fig. 1, and the addition of three new models to the Caser line of radial drills, Fig. 2, now available in this country. The improvements made on Clover lathe Models 20/30 and 22/33, which have swing capacities over the bed of 20 and 22 inches, respectively, are hydraulic clutch and brake instead of the electro-magnetic clutch and brake previously employed; larger hole through spindle (2 13/32 inches in diameter); coarse thread attachment which multiplies all thread pitches by 3, the coarsest thread now being one-third thread per inch; totally enclosed quick-change gear-box; and apron control by a double multiple-disc clutch which is adjustable from the outside.

Apart from the automatic force-feed lubrication in the headstock, these lathes now are equipped with automatic force-feed lubrication for apron and bedways. Hardened bedways are available as before.

Three new models have been added to the Caser line of radial drills, one of which is shown in Fig. 2. These models have 21-, 25-, and 29-inch columns with 7-, 8-, and 10-foot arms, respectively. They feature electrohydraulically preselected speeds and feeds which are obtainable without stopping the machine—thirty-two speeds from 12 to 1500 rpm. The spindle is controlled by a hydraulic multiple-disc clutch which requires no adjustment. The spindle quill slides in a special chrome-nickel, cast-iron replaceable sleeve having a hardened and ground mirror-finish surface.

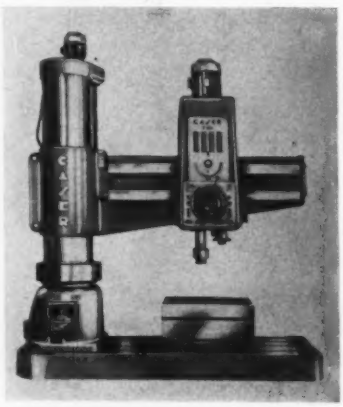


Fig. 2. One of three new model radial drills added to Caser line

There is an electromagnetic overload safety device for the feed. Push-button control for the up-and-down movement of the arm is combined with the automatic locking and unlocking of the arm on its column. Electrohydraulic push-button clamping of column and drilling head is also provided.

Circle 593 on Readers' Service Card

(This section continued on page 172)

Did you know this about foreign competition?

Foreign manufacturers who are actively competing for markets in the U. S. and throughout the world have enjoyed some real cost advantages in the past. Today they are faced with labor shortages and rising labor costs which are whittling down their profits.

What are they doing to solve these problems? They are turning to the one proved answer that exists today—automated special machinery which CONTROLS production costs and gives them back their competitive edge.

The fact that these operations may be, relatively, smaller than their U. S. counterparts doesn't mean that they can't use automated special machinery successfully. On the contrary, such equipment (already proved practical in limited production in the U. S.) is the *only* solution to many of their cost problems.

As one of the early pioneers in special machinery for low-cost production, Snyder is especially well qualified to explore, with your engineers, the successful use of such equipment in your operation, here or in Europe. It costs nothing to do this and we'll be glad to talk with you.

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Fig. 1. Force-Flo die feeder installed on a Stokes fifty-one-station high-speed rotary tableting press

Fig. 2. Underside of floating shoe of the die feeder, Fig. 1, which is positioned over the die bores

"Force-Flo" Die Feeder for Rotary Tableting Presses

Dry-blended powders can be tableted in a single operation with the new "Force-Flo" die feeder for rotary presses developed by the F. J. Stokes Corporation, Philadelphia, Pa. This feeder eliminates wet mixing, drying, granulating, slugging, and other preparatory steps. It will efficiently feed granular, semigranular, and sluggish-feeding materials at high speeds. This results in denser, higher-quality tablets with less pressure, since it minimizes air-entrapment, laminating, and capping. There are no moving parts in contact with the material, thus there is no chance of contaminating the tablets by metal chips, flakes, or lubricant from the equipment. These features have significant advantages for powder-metal parts.

The die feeder is a simple, self-contained attachment whose principal element is a specially designed feed frame that is interchangeable with the standard feed frame and can be installed on the press as shown in Figs. 1 and 2, or removed from it with the same ease as a standard feed frame. The special feed frame consists of a closed floating shoe with an integrally built-in power unit. The shoe is mounted on the feed frame by means of special rubber pads, so that it is stable around its vertical axis but free to move in the horizontal plane.

The hermetically sealed power unit uses compressed air—the simplest possible source of power—to generate a continuous orbital movement of the shoe in the horizontal plane. The shoe is moved an exact amount, horizontally and in the proper direction, to coincide with the rotation of the rotary head of the press for the most efficient feeding action.

The frequency of the movement of the shoe can be adjusted over a wide range (to suit the particular material being tableted) simply by increasing or decreasing the air pressure. This high-frequency movement of the entire shoe is said to provide a surface to which no material will adhere. Neither the intensity of the movement nor the length of time that material remains in the unit is enough to separate the ingredients, but it is sufficient to de-aerate the material to the equivalent of a tapped density. The connection between the top of the shoe and the hopper is vented to allow air to escape.

The partially closed aperture at the bottom of the shoe is positioned directly over the open die bores for almost the full length of a standard feed frame. The rotation of the rotary head of the press pressurizes the material in front of the partially closed aperture of the shoe and forces it into the die bores. Overfilled material is ejected from the die bores with a standard weight-adjuster cam at the trailing end of the feed frame, just as in conventional frames. This spill-out takes place in front of the partially closed aperture. The excess material is recirculated around the die table and returned to the open end of the shoe.

The other element of the die feeder is a compact control box, which is mounted at the rear of the press and houses dial gages for indicating the air pressure and simple controls for easy and accurate adjustment. It also includes a safety device to stop the press automatically in case the air supply should falter or be accidentally cut off.

Circle 594 on Readers' Service Card

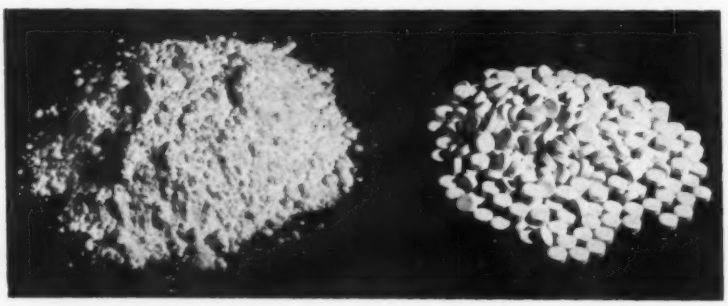
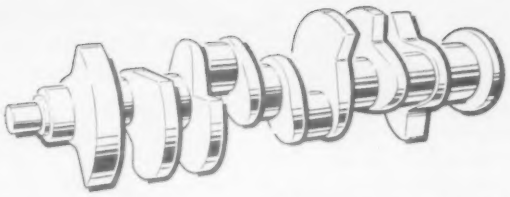
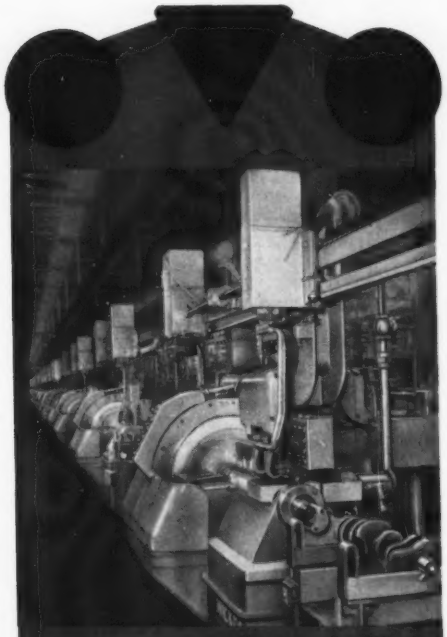


Fig. 3. Dry-blended powder like this in the range of 150 to 200 mesh and having the appearance of common flour has been successfully fed at speeds of 2000 tablets per minute with the new Stokes Force-Flo die feeder



COST-CUTTING EFFICIENCY!



The versatility of the WICKES CH-4 Center Drive Lathe is illustrated in this view of a fully-automated multiple installation. Lathes are equipped with automatic loaders and unloaders, automatic power chucks, hydraulically operated headstock and tailstock, live centers, central coolant system, chip disposal through bed, pre-set tool bits and solid rear cross slides.

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CRANKSHAFT TURNING

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MACHINE TOOL

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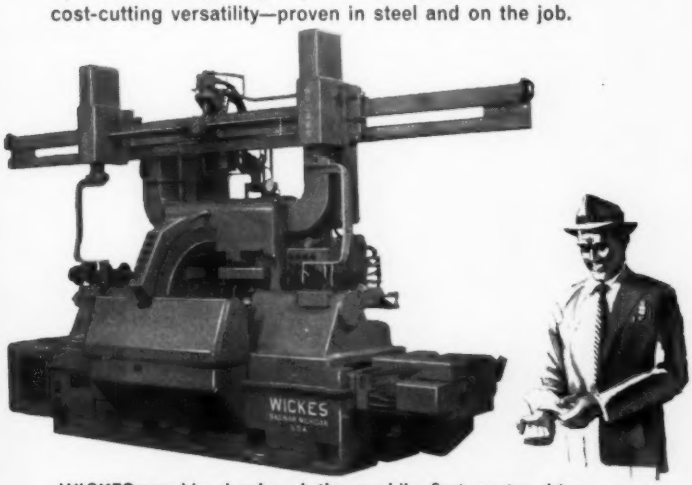
PROVEN IN PRODUCTION . . . AND IN STEEL . . . WITH WICKES CENTER DRIVE CRANKSHAFT LATHES

VERSATILITY TO MATCH YOUR MOST CRITICAL JOB REQUIREMENTS—proven in steel by WICKES-created Center Drive Lathes, the only complete line of Center Drive Crankshaft Lathes built in the world. Here's a versatile line of rugged, maintenance-free lathes designed to efficiently turn the main line bearings and ends of a wide range of forged or cast crankshafts to tolerances that eliminate the need for any finish turning slides. Does the job on either a high or low production line.

WICKES Center Drive Lathes, with all tooling mounted on heavy cross slides, cut your tooling costs. Down time is reduced with mounting plates that allow quick change-over of all tooling from one crankshaft to another. Center Drive Crankshaft Lathes—pioneered by WICKESmanship—let you profit *before* production, with cost-cutting versatility—proven in steel and on the job.



WICKESmanship developed the world's first center drive crankshaft lathe and builds all of the specialized variations . . . CH-2, CH-4, CH-8, and CH-10, with 2, 3, and 4 slides . . . all available in this production proven series, and all giving consistent conformance to rigid tolerances, as demanded by the most exacting crankshaft manufacturers.

division of the
WICKES corporation

For more data circle this page number on card at back of book

Expert Automated Welding Machine for Fabricating Flywheel Assemblies

A single-station, automated rotary welding machine that welds a ring gear to a hub in the fabrication of flywheel assemblies is now available from the Expert Welding Machine Co., Detroit, Mich. The particular machine shown is easily adaptable to different types and sizes of flywheel assemblies through the interchanging of tooling. It welds a gear with a 13 1/4-inch inside diameter to a hub with twelve equally spaced 1 1/8-inch CO_2 shielded-arc welded segments at a production rate of 171 flywheel assemblies per hour.

The ring gear and hub to be welded are manually loaded on the inclined fixture at the front of the machine. The automatic welding operation is then initiated through a push-button control. At the start of the cycle, the chuck jaws and toggle clamp automatically secure the assembly in position, and the overhead arm pivots downward, clamping the hub and positioning the welding head on the weld line.

The part is then rotated through the weld sequence by the continuously running cam drive. The machine automatically stops after one revolution of the part. At the end of the automatic welding operation, all clamps open and the overhead arm pivots to starting position. The completely welded assembly is then removed.

Circle 595 on Readers' Service Card

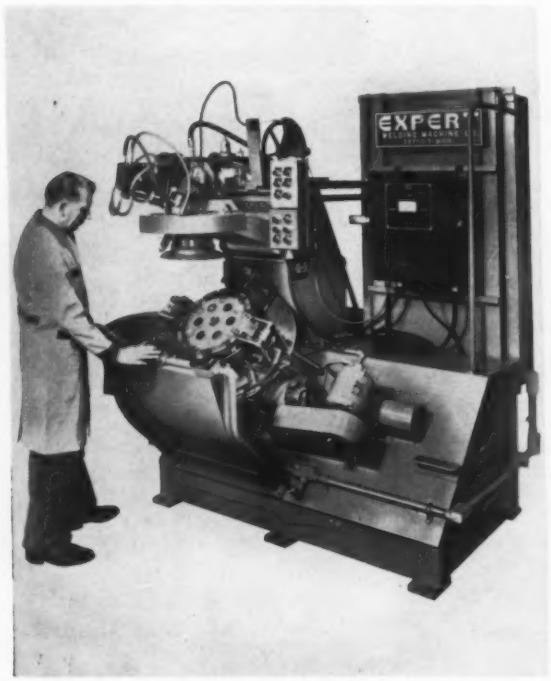
Ther-Monic Unit Designed for Precise Hardening of Bearing Races

Despite narrowness of parts, uniform hardness is said to be achieved on an angular surface of ball-bearing races, while hardness itself is restricted to a depth of only 0.015 to 0.020 inch, by a Ther-Monic unit designed and built by the Induction Heating Corporation, Brooklyn, N. Y. The machine and work-coil are designed to heat the "working surface" of the part to a temperature of more than 1650 degrees F., while metal at a depth of only 0.020 inch is not heated enough to become hardened. This is said to be accomplished with a minimum of power consumption, only 5 kw of energy being required to do the delicate surface-hardening job.

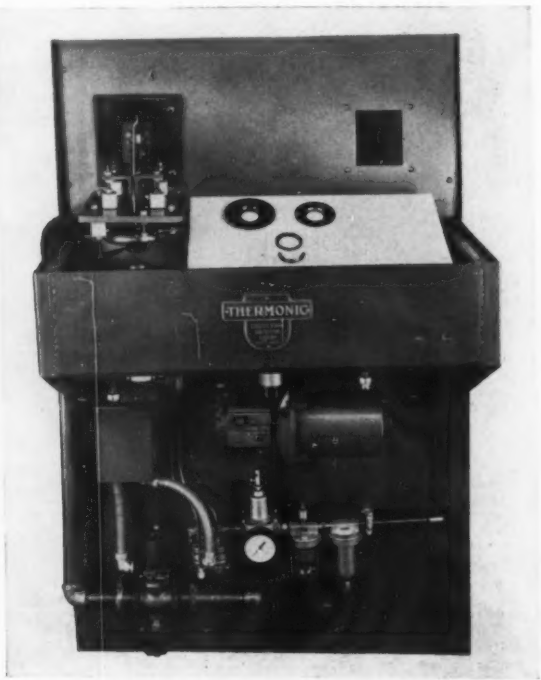
Uniform heating is obtained by first loading the parts in the work-fixture away from the heating zone of the work-coil. The fixture is designed to permit the operator to raise and lower the work at his discretion. To insure all-over heating, the piece is rotated within the work-coil area. The overhead location of the work-coil permits introduction of the quench medium from the top.

The hardening is done by a Ther-Monic Model 500 generator, with 5-kw output, and with a heating cycle of two and two-tenths seconds. Adding another two seconds for quenching of the part brings the time required for this precise hardening job to less than five seconds.

Circle 596 on Readers' Service Card



Automated welding machine for fabricating automotive assemblies, built by Expert Welding Machine Co.



Ther-Monic unit built by Induction Heating Corporation for precision hardening job

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CUSTOM GEARS and GEAR BOXES permit *complete freedom* in design. You specify and get gearing made precisely to your exact requirements.

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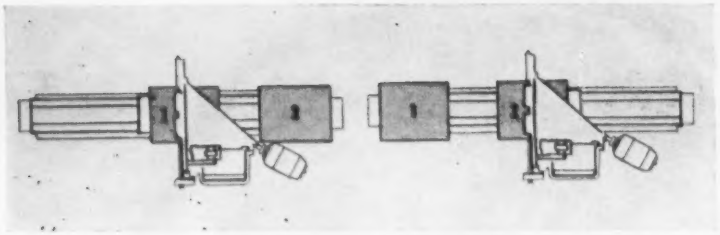


Fig. 1. Top-view diagrams of new duplex-table setup now optional on Gray Flying Scot planer

Optional and Regular Equipment for Flying Scot Planer

Duplex tables are now available as an optional feature on the new Flying Scot small-size planer recently introduced by the G. A. Gray Co., Cincinnati, Ohio. This planer, illustrated and described in February, 1961, MACHINERY, page 153, allows work to be loaded on one section of the table at the same time work is being planed on the other section. This duplex feature, illustrated diagrammatically in Fig. 1, greatly minimizes setup time and permits continuous operation of the planer.

The diagram at the left shows work being planed on table No. 1 while table No. 2 is being loaded. At the completion of the job, table No. 1 is moved to the end of the bed, and table No. 2 is moved into position fully loaded with the aid of a quick-acting precision latch attachment. To complete the endless cycle, finished work is unloaded from table No. 1, which is then reloaded. Tables are quickly shuttled back and forth, making it unnecessary to shut the planer off at any time.

The new Gray Flying Scot planer now features nine combinations of table widths and heights. Basic sizes are 30, 36, 42 inches.

Another outstanding feature of the Flying Scot planer is its helicone transmission, an entirely new concept of a gear and rack drive. This drive results in a high overall efficiency made possible by the extreme simplicity of the mechanism. The helicone transmission consists of a pinion, gear, and bull drive gear as shown in Fig. 2. It produces no side thrust whatever against the table, as is the case with a straight rack assembly, and provides a flow of cool, pulse-free power. Because of the Flying Scot's double-cutting, high-speed planing characteristics, the elimination of thrust and deflection is of major importance.

The bull gear-shaft is made short and of large diameter to reduce deflection to a minimum. The motor drive-shaft on a 20-degree angle relative to the vee, and the bull gear-shaft on a 20-degree angle from the transverse plane, place the motor in the most desirable location at the rear of the column. This drive is extremely smooth due to overlapping tooth action between rack and bull gear. There are always three or more teeth in mesh. The cone gears are smooth acting due to the enveloping configuration of the pinion and gear.

Circle 597 on Readers' Service Card

Profilometer Pilotor for Checking Roughness

The Micrometrical Mfg. Co., Ann Arbor, Mich., has brought out a Type RE rotary Pilotor unit which provides a means for high-production checking of average surface roughness in micro-inches around both internal and external surfaces of rotation and across the radii of small parts. Both reciprocating and continuous tracing motion are provided, making this equipment adaptable to a wide range of parts. Surfaces of rotation or radii from approximately

(Continued on page 180)

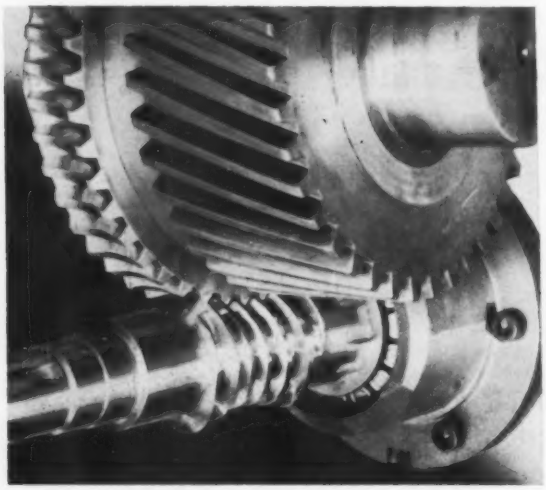
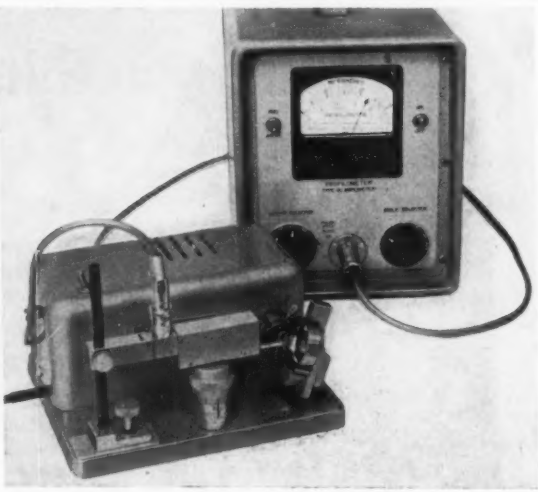


Fig. 2. Close-up of bull gear-shaft and motor drive-shaft of helicone transmission of Flying Scot planer



Type RE rotary Pilotor for checking surface roughness brought out by Micrometrical Mfg. Co.

cool · tough

DASCO SUPER SOLUBLE BASE

water-mix cutting fluid

Stuart

Under adverse conditions—on jobs too difficult for regular water-mix cutting fluids, yet not suited for straight petroleum oils—Stuart's Dasco Super-Soluble Base will improve performance and profits, reduce costs.

Here is a water-mix cutting fluid with a sulfochlorinated fatty oil base that assures proper chip formation, prevents welding, and reduces heat-generating friction under extreme circumstances. It is a heavy-duty soluble oil that permits machining of stainless, low carbon steels, monel, and jet engine alloys with economical tool life and fine surface finish. Even at slow cutting speeds, the chemically active extreme pressure additive in Dasco Super-Soluble provides antiweld protection at the tool-chip interface—prevents edge build-up and cratering of tools.

Dasco Super-Soluble gives you high lubricity, antiwear, and antiweld qualities, plus the high cooling capacity inherent in a water-mix cutting fluid. It is ideal for heavy-duty turret lathe work, high-speed turning with carbides, tough form milling, boring, and surface or round-hole broaching. Use it at 40 to 1 for turning, drilling, milling, boring, sawing, and reaming—15 to 1 for broaching.

here comes real detergency

Stuart's new Hi-D

transparent metalworking compound

Hybrid compound keeps grinding wheels open and free-cutting, minimizes machine tool maintenance.

Now, today, there is a metalworking compound that offers extra-high detergency for stress-free grinding, yet does not attack paint, remove way lubricant, or leave crystalline deposits on the machine . . . that lubricates as it cleans, yet does not leave an oil film on the chuck . . . that is just as clear as any synthetic compound, yet is a petrochemical-type solution that is effective and stable at 60:1.

Hi-D is one of the outstanding lubrication developments in Stuart's 90-year history. Yet, it costs less per drum than most "coolants"—up to ⅓ less at proper dilution than some high-priced cutting fluids.

No other cutting and grinding compound is anything like it. Best described as a hybrid, it has all the qualities you look for in a synthetic without any of the disadvantages.

Stuart

D. A. STUART OIL CO., LIMITED
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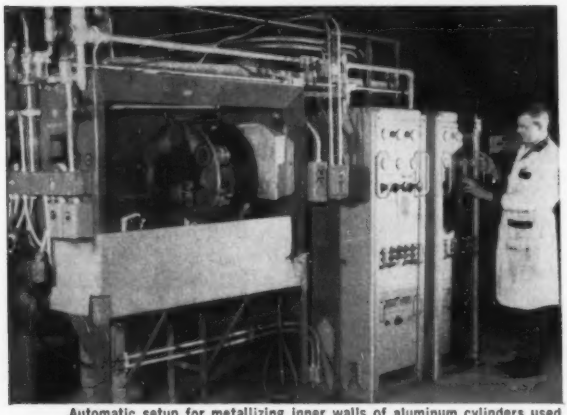
Canadian D. A. Stuart Oil Co., Limited, P. O. Box 430, 43 Upton Road, Scarborough, Ontario, Canada

Flame sprayed metal increases wear resistance better than 10 times

AIDS WEIGHT REDUCTION



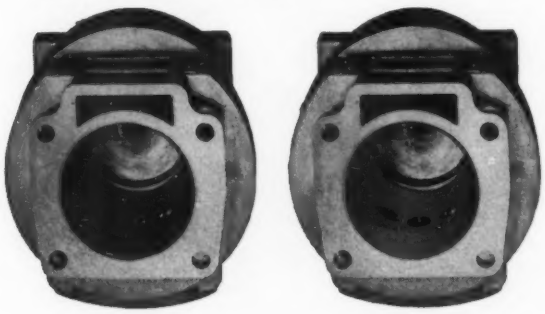
Automatic setup for metallizing inner walls of aluminum cylinders used in lightweight gasoline engines. Cabinet in foreground houses six-station rotary setup; automatic control panels are at right.

Many methods, including cast-iron cylinder liners and chrome plating, have been tested for wear resistance in lightweight gasoline engine blocks of aluminum.

Best of these methods experienced breakdowns in less than 400 hours. Now they are metallized with METCO Sprabond (molybdenum alloy) as a bonding agent, followed by a coating of sprayed steel alloy.

Test runs of over 4,000 hours show little or no wear of the metallized surface. Finish thickness is .007"; weight – a few grams. Cast-iron liners weighed almost ½ pound.

Cylinder at left machined ready for flame spraying; one at right has been metallized and hone finished.



Closeup of automatic six-station rotary setup. Cylinders are individually rotated at 150 rpm. Cylinder is loaded on table at Station 1, moved through Stations 2 and 3 for pre-heating by torch. At Station 4, bonding coat is applied by the gun nozzle which feeds into the rotating cylinder. Low alloy steel is applied at Station 5 and cylinder cools at Station 6. Cylinder walls are finished by honing.

New engineering data bulletin

Bulletin 136B—The METCO Flame Spraying Processes, provides basic engineering and application data on flame sprayed coatings of metals, ceramics, carbides and other high melting point materials. 16 pages. Send coupon for free copy.

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Don Watson
Please send Bulletin 136B.

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company

address

city zone state

For more data circle this page number on card at back of book

1/32 inch to approximately 2 inches or more can be handled easily with this versatile device.

The selection of any desired arc of trace from 10 to 350 degrees, with automatic reversals, has been provided for. The Type RE Pilotor shown in the lower left of the illustration is used in conjunction with a standard Profilometer amplimeter and tracer. The amplimeter, upper right of illustration, is sturdy and portable and requires only a thirty-second warm-up to put it into operation. Either arithmetical or rms average readings are possible. The K type tracer is mounted to the left on the base of the Pilotor unit. The piece to be measured is held in an adapter shown at the right.

Circle 598 on Readers' Service Card

Cleereman Two-Spindle Drilling and Tapping Machine

A Cleereman two-spindle drilling and tapping machine, called Series "A," which is readily adaptable to special applications is announced by the Jackson-Fotsch Co., general distributors for Cleereman Machine Tool Corporation, Chicago, Ill. Two or more columns are mounted on a special base, and with the use of rotary type index-tables, make high production with precision possible. A complete cycle is obtained at all stations simultaneously. While the tools are working, the operator removes the finished part and loads another.

At the touch of a button, a complete, automatic cycle is obtained, producing a drilled and tapped hole without further work. Ease of setup; pick-off change-gears; and broad ranges of speeds, feeds, and tap leads adapt this machine for either small-lot or production runs. The building-block concept of construction provides low-cost initial investment and basic machine elements for change-over to new and different piece parts. The machine is also available in automatic single-spindle and multiple-head designs.

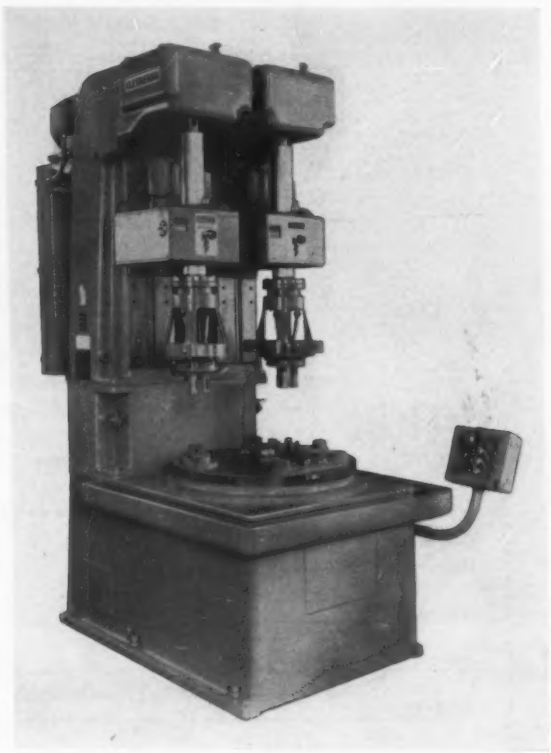
Circle 599 on Readers' Service Card

Ampak Electrolytic Drill Sharpener

Connecticut Special Machine, Inc., Winsted, Conn., has announced the new Ampak electrolytic drill sharpener for high-speed-steel twist drills. It is said to speed the sharpening rate from three to seven times faster than conventional grinding, but does not generate the heat of conventional methods that may alter the structure of the metal. A greater degree of control of drill-point geometry is also claimed to be possible through a simple setup of drill-holding fixtures that can be made in seconds. Duplication of complex "special" drill points can be accomplished one at a time or on long, uniform, exacting production runs. This control, uniformity, and exacting drill-point geometry are said to extend drill life from two to ten times.

The versatility of this sharpener allows all drill-point angles from 90 to 180 degrees, lip-relief angles from 0 to 20 degrees, and helix angles from 30 degrees positive to

(Continued on page 194)

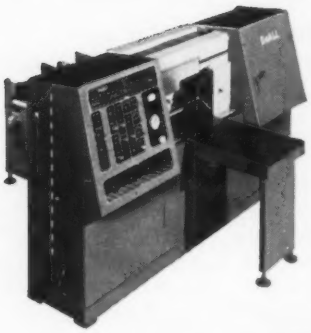


Cleereman two-spindle drilling and tapping machine

Ampak electrolytic drill grinder or sharpening machine

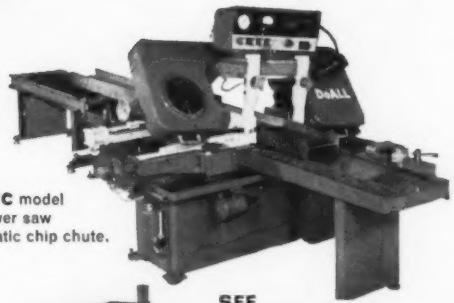
Another DoALL FIRST!

NEW SAW BLADE has tungsten carbide inserted teeth!



Continental Production Saw for continuous, heavy-duty cut-off production—fully automatic.

CUTS
TWICE AS FAST!
Up to 35 sq. in./min. in 1018 C.R.S.
TWICE AS MUCH!
Resharpenable several times



New C-70TC model DoALL power saw with automatic chip chute.

It's another breakthrough by DoALL! The new Tungsten Carbide* band and machines shown here achieve fantastic performance in metal sawing.

For round-the-clock, faster cutting, this new band machining team sets new standards in productivity. This all-new blade combines the hardness of tungsten carbide teeth with the toughness of spring-tempered steel to give you the longest lasting, most heat-resistant and fatigue-resistant materials ever used in a saw band. Ground to dimension and sharpness, tungsten carbide teeth are uniformly set for high precision sawing. These new machines have the power, rigidity, controlled speed and feeds to fully utilize the cutting ability of tungsten carbide.

** Patent applied for*

SEE
Demonstration
ASTME SHOW
New York—May

DoALL Band Mill for heavy-duty slabbing, shanking, refacing, etc.—two-ton capacity.

You Get These ADVANTAGES

- Most accurate sawing ever attained
- Teeth with highest red-heat hardness
- Teeth that withstand tremendous abrasion
- Teeth ground sharp for fastest cutting rate
- Band beam strength for heaviest feeds
- Spring-tempered alloy band for longest flex life
- Greatest productivity and economy

Call your local DoALL Sales-Service Store for complete data on this phenomenal saw band and demonstration on new Model C-70TC power saw.

SB-86

Your DoALL Sawing Specialist has a new desk-side movie on tungsten carbide sawing. Call him today.

Find Your DoALL STORE In The "Yellow Pages"

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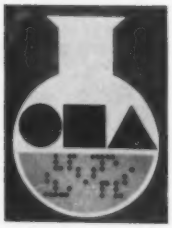
NEW CATALOGUES

Catalogues bring details of new products to prospective buyers in clear, concise form. Yours for the asking . . . use postcard inside back cover

Gun-Drilling Machine

Jones & Lamson Machine Co., Springfield, Vt. Bulletin containing details on the J&L precision gun-drilling machine, which is designed to handle drills from 1/2-inch diameter to the smallest sizes available in gun drills. Specifications are given.

Circle **Item 503** on Inquiry Card



Metalworking

Linde Company, division of Union Carbide Corporation, New York City. Bulletin (Vol. II, No. 6) containing articles on Linde equipment and processes. Among other subjects, Sigma, Heliarc, Short Arc, and Unionmelt welding and fixtures are described.

Circle **Item 504** on Inquiry Card

Drilling and Tapping Machine

Burg Tool Mfg. Co., Inc., Gardena, Calif. Bulletin giving specifications on the Burgmaster Model 3BHT-B tape-controlled, eight-spindle turret drilling, tapping, and boring machine. The design utilizes double-housing planer type construction.

Circle **Item 505** on Inquiry Card

Lock-Nuts

Klincher Locknut, Inc., Indianapolis, Ind. Brochure on the University of Minnesota's photoelastic analysis of Klincher lock-nuts, which resist high-frequency vibrations and high temperatures and have double-locking action (radially and axially).

Circle **Item 506** on Inquiry Card

Punch-Press Clutch

Benchmaster Mfg. Co., Gardena, Calif. Brochure describing the positive electromagnetic clutch available on 5-, 8-, and 10-ton Benchmaster punch presses. Featured are instant engagement or release, no sliding keys or dogs, and positive electric brake.

Circle **Item 507** on Inquiry Card

Cold-Heading Tools

Plew Tool Corporation, Columbia City, Ind. Catalogue covering the company's complete line of cold-heading, forming, and cutting tools. Also pictured are special tools—hollow mills, seating and trepanning tools, reamers, core and spade drills, etc.

Circle **Item 508** on Inquiry Card

Arbors

Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalogue No. M-2029 on the company's arbors and accessories. Described are arbor adapters and collets, Arbor-Loc spindle nose, shell end-mill arbors, and straight-shank end-mill holders.

Circle **Item 509** on Inquiry Card

Bolts

Standard Pressed Steel Co., Jenkintown, Pa. Selection guide to SPS bolts for the aerospace industries. Covered are material selection, fabrication, and quality control of these critical high-strength and high-temperature fasteners for aircraft, missiles, etc.

Circle **Item 510** on Inquiry Card

Timing-Belt Drives

T. B. Wood's Sons Co., Chambersburg, Pa. Catalogue No. 19103 presenting timing-belt drives for mechanical power transmission, which are available for load capacities from fractional horsepower to 600 hp and for belt speeds up to 16,000 fpm.

Circle **Item 511** on Inquiry Card

Filter

Gale Separator Co., division of Infilco Inc., Tucson, Ariz. Bulletin 9020-B on the Impinjo filter for cleaning coolants and cutting oils containing ferrous and nonferrous contaminants. Design principles and suggested specifications are provided.

Circle **Item 512** on Inquiry Card

why Ampex uses NIKON OPTICAL COMPARATORS

The new Ampex AR-300, developed principally for military and scientific applications, is the only recorder capable of covering a 4-megacycle bandwidth. It can capture and record phenomena beyond the range of any equipment in use today.

The most vital component in the AR-300 is its rotating recording head, designed to achieve the high, head-to-tape velocity required for wide band response, yet maintaining a relatively low, reel-to-reel speed.

Nothing in the manufacture of the AR-300 proved as critical as the production of this head. Most of its parts did not lend themselves to conventional inspection methods. While .0001" tolerances had to be maintained, Ampex standards call for inspection equipment capable of at least 10 times the required accuracy.

This inspection problem was finally solved when the task was assigned to a Nikon 6 Optical Comparator. Not only did the Nikon Comparator provide the exact measurements required during 'in-process' inspection, but it also permitted consistent duplication of these measurements, time after time.

Today, the Nikon 6 has a permanent position on the AR-300 production team. Furthermore, there are now five additional Nikon comparators serving Ampex in other production projects, and in development—helping to maintain the high quality standards for which Ampex products are justly famous.

Why not investigate what a Nikon comparator can do for you? Write for complete, illustrated catalog to Dept. M-3.

NIKON INCORPORATED, 111 FIFTH AVE., NEW YORK 3, N. Y.

Ferrite Coil Under Inspection Showing Size Relationship

• Yours for the asking . . . use postcard inside back cover

Height-Setting Devices

Van Keuren Co., Watertown, Mass. Buyer's catalogue (Section H, No. 36) describing Hyt size-gage units. Applications include inspection of angular center line, checking variables in height combinations, and checking jig-bored hole coordinates.

Circle **Item 513** on Inquiry Card

Presses

Havir Mfg. Co., St. Paul, Minn. Catalogue sheet featuring information on the Press-Rite Juniorline series power presses, which are available for bench or floor mounting. Covered are the 5- and 10-ton presses, both standard and deep-throat models.

Circle **Item 519** on Inquiry Card

Circular Form Tools

Somma Tool Co., Waterbury, Conn. Catalogue No. 61 covering the company's complete line of standard circular form tools and blanks for use in automatic screw machines. Featured are cutoff and form tool blanks made of T-15 Vasco Supreme H.S.S.

Circle **Item 514** on Inquiry Card

Coil Cradle

Benchmaster Mfg. Co., Gardena, Calif. Bulletin presenting information on the company's Koil-Kradle, a motor-driven device for cradling and supplying material to any machine at any desired rate. A description of a variable time delay is included.

Circle **Item 520** on Inquiry Card

Numerical-Control Systems

Bendix Corporation, Industrial Controls Section, Detroit, Mich. Catalogue No. 308 giving data on the company's line of numerical-control systems, covering the DynaPath-20 series contouring controls and DynaPoint-20 and Ferranti positioning control systems.

Circle **Item 515** on Inquiry Card

Manufacturing Facilities

Hardinge Mfg. Co., a subsidiary of Hardinge Co., Inc., York, Pa. Bulletin 101 giving a description of the company's various tools and fabrication facilities. Patterns, castings, machine work, plate-steel work, and custom machinery are included.

Circle **Item 521** on Inquiry Card

Multiple-Wheel Grinder

Landis Tool Co., Waynesboro, Pa. Catalogue IWR-60 covering the Landis 10- and 14-inch Type IWR semiautomatic wheel grinders whose principal advantage is the ability to simultaneously grind multiple line diameters in one operation.

Circle **Item 516** on Inquiry Card

Bar Automatic

Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin presenting the Cleveland 2½-inch Model "AW" single-spindle bar automatic. Featured are variable forward and return turret feeds controlled through an improved mechanical drive.

Circle **Item 522** on Inquiry Card

Milling Machines

Kearney & Trecker Corporation, Milwaukee, Wis. Bulletin RS-60 describing the firm's S-12 ram-head milling machines, which are available with Type U universal swivel head, Type Q adjustable-quill swivel head, or Type V vertical swivel head.

Circle **Item 517** on Inquiry Card

Noise Measurement

General Radio Co., West Concord, Mass. Handbook on the measurement of noise and vibration, describing equipment requirements and procedures. A comprehensive survey of such topics as the decibel, man as a noise-measuring instrument, etc., is offered.

Circle **Item 523** on Inquiry Card

Roll-Formed Shapes

Roll Formed Products Co., Youngstown, Ohio. Bulletin 760 describing the techniques used in roll-forming shapes from aluminum, brass, copper, zinc, and titanium; galvanized, stainless, and carbon steels; and painted, clad, and vinyl-coated metals.

Circle **Item 518** on Inquiry Card

Belts and Pulleys

Maurey Mfg. Corporation, Chicago, Ill. Catalogue PD-1 covering data on Maurey's positive-drive belts and pulleys. Specifications for 1/5-, 3/8-, 1/2-, 7/8-, and 1 1/4-inch pitch are included, along with Ful-Grip Q-D interchangeable bushings.

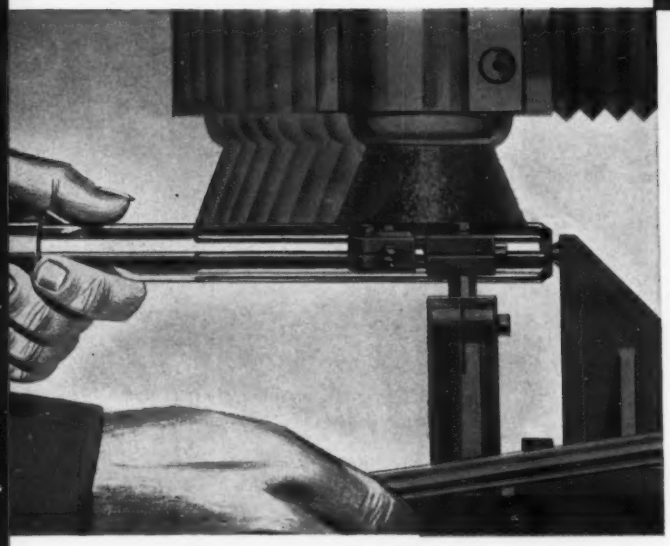
Circle **Item 524** on Inquiry Card

NOW FOR 1961

OLIVER OF ADRIAN "ACE" TOOL AND CUTTER GRINDER

The "ACE" tool and cutter grinder is a prime example of a simplified approach to a difficult problem. Face mills, reamers, end mills, staggered tooth cutters, slab mills, spot facers, etc.—straight or spiral—are quickly, easily and economically sharpened with the Oliver "ACE." It is extensively used, too, for sharpening carbide-tipped circular saws.

Cost savings are attractive with respect to both set-up and grinding time. Set-up usually consists of two simple "direct reading" adjustments. The work holding unit is set and the grinding wheel spindle is tilted to produce the proper clearance. It's that simple!



Traverses the wheel . . . not the work

You can grind tools and cutters faster with Oliver's "ACE" because the wheel is brought to the work, reversing the usual process. Normal maintenance due to abrasive matter is eliminated because the major moving parts are above the grinding area and are completely sealed. *Accuracy is assured because the wheel is trued by a stationary diamond which provides a fixed grinding line.* It is not necessary to compensate for wheel wear.

Designed specifically for the job

The numerous features of the "ACE" set it apart from a general purpose machine adapted to tool room work.

- Easy to set up. All angles are obtained by direct reading.
- Operator stands in a natural position with the control lever in easy reach and the work in direct view.
- Grinding time is reduced because it consists wholly of bringing the grinding wheel on and off the cutting tool—tool travel is eliminated in most cases.
- Special attachments, such as those used for radius work and for sharpening flat broaches, extend the machine's range of application.

Look to Oliver for the modern approach to your cutter grinding jobs. Write for complete information and quotations.

OLIVER of ADRIAN
1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL AND CUTTER GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES.

• Yours for the asking . . . use postcard inside back cover

Air Cylinders

Mo-Bar Hydraulics Co., Crystal Lake, Ill. Bulletin No. 202 giving a description of Mo-Bar air cylinders. Featured is the use of four Allen head capscrews in place of conventional protruding hex nuts, and an improved rod cartridge design.

Circle **Item 525** on Inquiry Card

Clamping Cylinders

Airmatic Valve, Inc., Cleveland, Ohio. Bulletin 91036 featuring the company's single- or double-acting clamping cylinders in 1 1/2-, 2 1/4-, and 3-inch bore sizes. Specifications, optional features, ordering data, and dimensions are given.

Circle **Item 531** on Inquiry Card

Ball Bearings

Fafnir Bearing Co., New Britain, Conn. Brochure containing data on the company's wide inner-ring ball bearings. Also described are transmission units, such as pillow blocks, flange cartridges, cylindrical cartridges, and take-up units.

Circle **Item 526** on Inquiry Card

Keyseater

Star Cutter Co., Farmington, Mich. Catalogue SC-153 describing the company's Model 25 automatic-feed keyseater, which produces keyways up to 2 1/2 inches wide and 22 inches long in toolrooms and low- and medium-rate production parts.

Circle **Item 532** on Inquiry Card

Boring-Bars

Giddings & Lewis Machine Tool Co., Davis Division, Fond du Lac, Wis. Catalogue No. D-520-A explaining the Davis boring-bar tooling system and listing a line of bars and related tools and accessories. Included are three new stub-boring tool sets.

Circle **Item 527** on Inquiry Card

Cutoff Machine

Allison-Campbell Division, American Chain & Cable Co., Inc., Bridgeport, Conn. Bulletin DH-63 presenting the Model 412 wet-abrasive cutting machine, designed for cutting-off operations in steel mills, forge shops, and other heavy industries.

Circle **Item 533** on Inquiry Card

Shaft-Mounted Drives

Falk Corporation, Milwaukee, Wis. Bulletin 7100 presenting design, selection, and dimensional data on shaft-mounted drives and a series of flange-mounted drives which cover a torque range up to 44,000 pound-inches. Also featured are Equi-Poised motor mounts.

Circle **Item 528** on Inquiry Card

Clutches

Formsprag Co., Warren, Mich. Catalogue No. 142 on Rawson automatic centrifugal clutches and clutch couplings designed for a wide range of industrial power-transmission applications. Typical examples and dimensional data are provided.

Circle **Item 534** on Inquiry Card

Shape-Cutting Machine

Linde Company, Division of Union Carbide Corporation, New York City. Booklet (Form 55-040) describing how intricate metal parts can be reproduced from simple pencil sketches on ordinary paper with the Oxweld CM-56 flame-cutting machine.

Circle **Item 529** on Inquiry Card

Templates

Northwestern Tools, Inc., Dayton, Ohio. Brochure presenting a description of the company's tracing templates designed for companies who manufacture jigs, fixtures, and special machinery. A set of standard templates is offered free upon request.

Circle **Item 535** on Inquiry Card

Blast-Cleaning Equipment

Pangborn Corporation, Hagerstown, Md. Bulletin No. 805 presenting information on the company's LK and LM Rotoblast Table-Rooms, designed to blast-clean pieces ranging from small parts to castings or weldments 10 feet wide and weighing 6 tons.

Circle **Item 530** on Inquiry Card

Hydraulic Power Units

Hannifin Co., a division of Parker-Hannifin Corporation, Des Plains, Ill. Bulletin 0980-B1 cataloguing thirty-seven hydraulic power unit models, including 1000- and 2000-psi single-pump units, double-pump units, and continuous booster units.

Circle **Item 536** on Inquiry Card

Around and Around They Go

Here on a Cross dial machine in a plant of a large manufacturer of steering equipment, are two GEOMETRIC Solid Adjustable SJ Taps equipped with CARBIDE CHASERS and rotary pilots.

Two by two, malleable iron Power Steering Housings arrive under the taps, acquire their 2¼-20 Class 3B threads and pass on in a matter of seconds.

Carbide Chasers have given such unparalleled dependability on this job that they are now standard on many GEOMETRIC installations in the plant.

Call your Distributor for an appointment with a GEOMETRIC Chaser expert.

INDUSTRIAL DISTRIBUTOR
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GEOMETRIC TOOL COMPANY

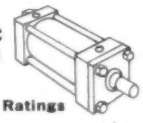
NEW HAVEN 15, CONNECTICUT

THIS...IS WHAT YOU BUY!

POWER — clean, dry, drip-free power at the business end of a Hannifin piston rod is the result of Hannifin extra quality, and at no extra cost. Bores are honed to 15 RMS or finer... piston rods are case hardened, plated and polished to 10 RMS or better. Cartridge gland, removable without dismantling cylinder, has exclusive Hannifin-developed "Lipseal®-Wiperseal" combination for a truly drip-free rod.

Modern straight thread leak-proof ports for easily positioned fittings are available at no extra cost on hydraulic cylinders.

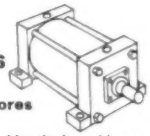
HYDRAULIC CYLINDERS



Two Pressure Ratings

2000 psi (3000 psi non shock), the famous heavy duty Hannifin Series "H" in 1½" to 12" bore.
1000 psi, Series "L", 1" to 8" bore, Hannifin quality in a lighter cylinder. Full compliance JIC Hydraulic Specs.

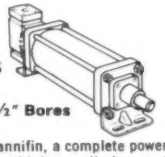
AIR CYLINDERS



1½" to 14" Bores

Series "A"—steel heads, honed brass body for corrosion resistance. Hardened and hard chrome plated piston rod. For all heavy duty air service. Easily modified for water service. Full compliance JIC Pneumatic Specs.

AIR MOTORS



1¾" to 4½" Bores

New from Hannifin, a complete power package combining cylinder and solenoid valve. Only one air line connection. Four mounting styles. Interchangeable mounting dimensions for most applications.

HANNIFIN COMPANY
A DIVISION
509 South Wolf Road • Des Plaines, Illinois
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS
EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

3128-PH

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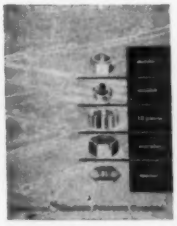
Turret Lathes

Jones & Lamson Machine Co., Springfield, Vt. Catalogue describing the J&L ram type turret lathes with multiple-speed hydraulic headstock. Features include instant speed changes, hydraulic clutches, no gear shifting, and single-speed motor.

Circle **Item 537** on Inquiry Card



Nuts

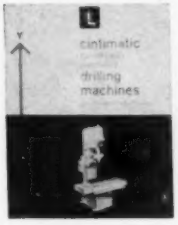
National Machine Products Co., Utica, Mich. Catalogue containing engineering data and specifications on hexagon nuts; Conelok, Huglock, and Marsden lock-nuts; specials; Weldnuts; twelve-pointer nuts; and AN (Air Force Navy aeronautical) nuts.

Circle **Item 543** on Inquiry Card

OBI Presses

Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 54 on the Series M line of open-back inclinable presses for automatic ultrahigh-speed operation with progressive dies. Included are specifications, die-space dimensions, and stroke shut-height data.

Circle **Item 538** on Inquiry Card



Drilling Machines

Cincinnati Lathe & Tool Co., Cincinnati, Ohio. Catalogue N-240 on the Cintimatic sliding-head drilling machines with programming and tape-control method of automatic table positioning. Specifications of the 24- and 25-inch models are given.

Circle **Item 544** on Inquiry Card

Rotary Table

AA Gage Co., Detroit, Mich. Catalogue UR-200 presenting specifications for high-precision Ultraron rotary tables, on which work-pieces can be mounted for lapping; vertical or horizontal grinding of surfaces, grooves, etc.; and inspection.

Circle **Item 539** on Inquiry Card

Beryllium-Copper Strip

Beryllium Corporation, Reading, Pa. Bulletin No. S-1100-A giving details on beryllium-copper strip products—their advantages, properties, and information as to selection of the right beryllium-copper alloy to meet specification requirements.

Circle **Item 545** on Inquiry Card

Blast-Cleaning Barrels

Pangborn Corporation, Hagerstown, Md. Bulletin No. 706 detailing the features of Pangborn's standard-duty line of blast-cleaning barrels, which are of use to manufacturers of castings, forgings, weldments, plastics, and to auto-parts reconditioners.

Circle **Item 540** on Inquiry Card

Drill-Point Sharpener

Detroit Reamer & Tool Co., Birmingham, Mich. Brochure giving details on the Tru-Kut Point Master, a self-centering drill-point sharpener that has free-cutting action. Included are descriptions of various types of Tru-Kut drill points.

Circle **Item 546** on Inquiry Card

Punches

Dayton Perforators Inc., Dayton, Ohio. Catalogue No. 603 giving specifications on the company's "Proven Usage Punch Sizes" (P.U.P.S.). Included are wire punches, round punches, pilots, round dies, elongated round punches and dies, etc.

Circle **Item 541** on Inquiry Card

Micrometers

J. T. Slocomb Co., South Glastonbury, Conn. Bulletin No. 2 describing a series of outside micrometer calipers in the 1- to 60-inch size ranges. Included are data on available optional features—lock-nut, vernier, friction stop, and friction thimble.

Circle **Item 547** on Inquiry Card

Boring Tool

Valenite Metals, a division of Valeron Corporation, Royal Oak, Mich. Catalogue No. KS-60A presenting Kamset multiple-point precision boring cutters, which utilize throw-away inserts to develop fine finishes and boring tolerances in tenths.

Circle **Item 542** on Inquiry Card

Screw Machines

Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin SM44 featuring a detailed comparison between new-design Brown & Sharpe automatic screw machines and machines of older design. Charts including capacities and other specifications are provided.

Circle **Item 548** on Inquiry Card

• Yours for the asking . . . use postcard inside back cover

Welding School

Lincoln Electric Co., Cleveland, Ohio. Bulletin AV-111 outlining the program in arc-welding education available at the Lincoln Welding School, which teaches the skills necessary for the use of various metallic arc-welding processes.

Circle **Item 549** on Inquiry Card

Drilling Machine

Cleereman Machine Tool Corporation, Green Bay, Wis. Catalogue No. 160 presenting details on the company's layout drilling machine, which is designed to meet requirements where the ultraprecision of the Cleereman jig borer is unnecessary.

Circle **Item 550** on Inquiry Card

Hole-Punching Equipment

Punch Products Corporation, Buffalo, N. Y. Brochure featuring information on Unipunch unitized tooling for presses and press brakes. The Unipunch method of hole punching and notching, typical parts and units, and mounting equipment are covered.

Circle **Item 551** on Inquiry Card

High-Alloy Castings

Alloy Casting Institute, Garden City, N. Y. Reprint, titled "How to Buy High Alloy Castings," discussing five rules to help the buyer obtain the best value when ordering high-alloy castings and typical questions that should be answered by the purchaser.

Circle **Item 552** on Inquiry Card

Numerical-Control Programming

Rohr Aircraft Corporation, Chula Vista, Calif. Bulletin covering Rohr N/C programming. Illustrated are parts produced by numerically controlled machines—a blowout door; mid-spar fitting; longeron, upper engine mount; and firewall frame.

Circle **Item 553** on Inquiry Card

Punch-Riveters

ACF Electronics Division, ACF Industries, Inc., Riverdale, Md. Brochure describing the ACF-Erco machine tool line, with emphasis on automatic punch-riveters and special fabrication systems. Included are flangers, stretchers, and stretch presses.

Circle **Item 554** on Inquiry Card

Hydraulic Motors

Double A Products Co., a subsidiary of Brown & Sharpe Mfg. Co., Manchester, Mich. Bulletin No. PP5 providing specifications, performance curves, and other data for British-built five- and seven-cylinder, high-torque, low-speed Staffa hydraulic motors.

Circle **Item 555** on Inquiry Card

Presses

Havir Mfg. Co., St. Paul, Minn. Bulletin presenting data on the Press-Rite power press line from 2- through 85-ton capacity. Included are the new 55- and 70-ton Press-Rite presses, available with Airflex air friction clutch and air-applied brake.

Circle **Item 556** on Inquiry Card

Centerless Grinder

Landis Tool Co., Waynesboro, Pa. Catalogue RCNT-60 describing and illustrating the new Landis 12R centerless grinder. The machine's extra stability, from the floor up, makes heavy cuts possible without sacrifice of finish or accuracy.

Circle **Item 557** on Inquiry Card

Valves

Ross Operating Valve Co., Detroit, Mich. Bulletin 323 giving engineering data for the new Ross Headline series fluid-power valve, which is available in twenty-five types. Specifications, features, C_v factors, and response time are provided.

Circle **Item 558** on Inquiry Card

Aluminum-Part Production

Kaiser Aluminum & Chemical Corporation, Oakland, Calif. Revised booklet providing technical data applicable to the production of automatic screw machine parts made of aluminum. Included are new machining ideas and tooling concepts.

Circle **Item 559** on Inquiry Card

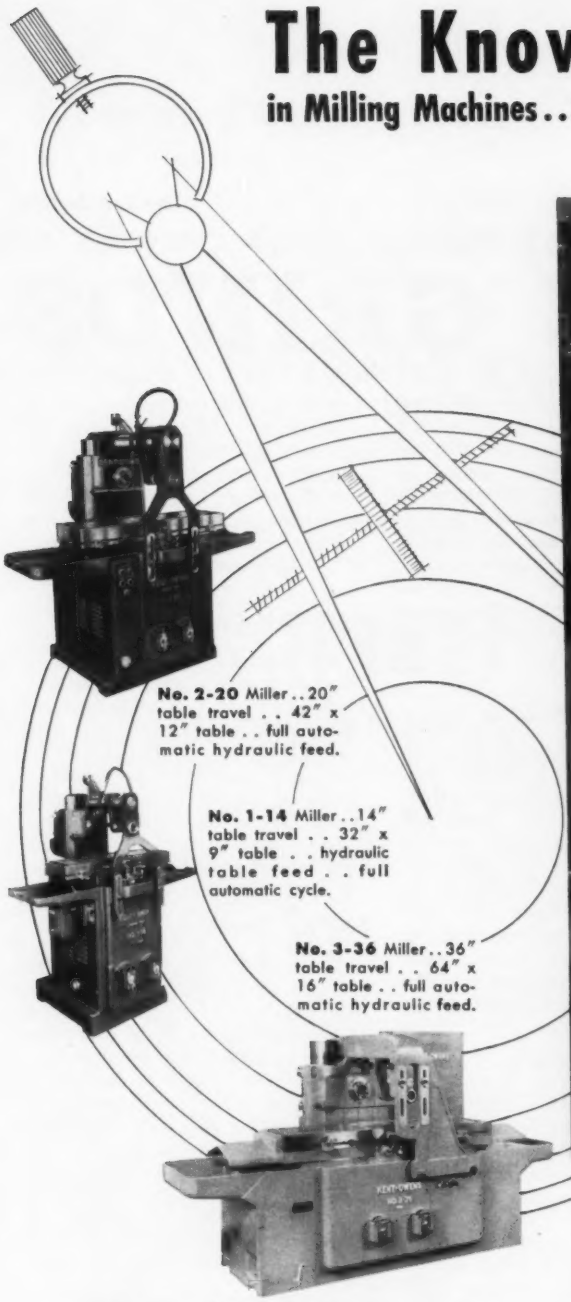
Cylinders

Hannifin Co., a division of Parker-Hannifin Corporation, Des Plaines, Ill. Bulletin 0230-B1 providing engineering data on the maximum 200-psi Series "S" Midget-Air cylinder. Both universal mounting and nose mounting models are described.

Circle **Item 560** on Inquiry Card

The Know-How Dimension

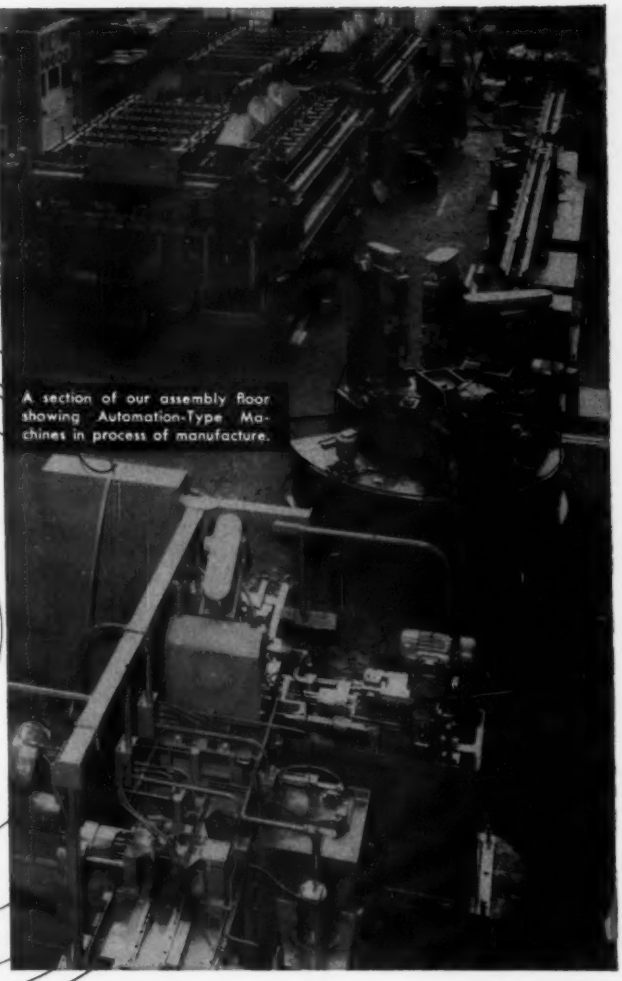
in Milling Machines . . Special Machinery . . Automation Equipment



No. 2-20 Miller . . 20″ table travel . . 42″ x 12″ table . . full automatic hydraulic feed.

No. 1-14 Miller . . 14″ table travel . . 32″ x 9″ table . . hydraulic table feed . . full automatic cycle.

No. 3-36 Miller . . 36″ table travel . . 64″ x 16″ table . . full automatic hydraulic feed.



A section of our assembly floor showing Automation-Type Machines in process of manufacture.

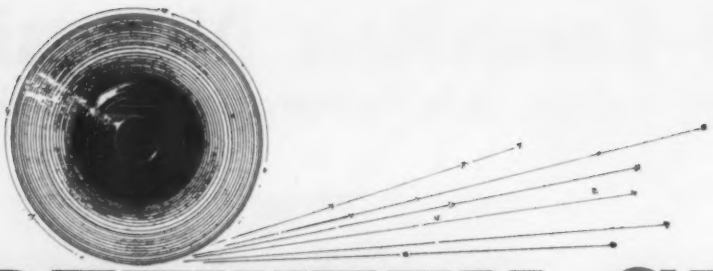
. . makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for *answers* to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS *Designers and Builders of Milling Machines and Special Machinery*



By E. S. Salichs

BETWEEN GRINDS

Forty with a Future

Next summer, forty men may enroll in a six-week course called "Modern Engineering for Engineering Executives," to be given by UCLA in the semi-isolation of the Ojai Valley. Cost of the course, including living accommodations, is $2340. If you can engineer that, we assume you are executive material.

Night and Day, and Night

According to *Industrial Research Newsletter*, a long-playing magnetic tape recorder has been developed in England that will play up to forty hours unattended. The unit is planned for use in civil aircraft, industry, and the entertainment world; but please, not the home.

Muscles and Meat

Perhaps you found a battery-operated carving knife under the tree Christmas morn, ready to save the master's muscles while hacking away at the turkey that day. Although we men do not exactly rely on a carving knife to keep fit, the thought crossed our mind that soon there will be little left to preserve physique.

Catch on to Cold

At the winter meeting of the ASME, a research scientist presented a paper, appropriately enough, on man's tolerance to cold exposure. Recovery from body temperatures as low as 9 degrees C. (48 degrees F.) is on record. Shivering can raise the body's heat production threefold but is a rather fatiguing type of motion, according to the scientist. But then so is shoveling coal.

Pigeon Post

The Interstate Steel Co. recently invested in seven pigeons, locating them at seven of their sales offices in the Midwest and training them to carry sales orders for steel to the main office in Chicago. For one thing, pigeons do not run up expense accounts (who ever heard of a pigeon stopping at a bar, except in New York, maybe); for another, there are no excuses about broken-down cars, late trains, and lack of airplane reservations. There is a fly —or feather—in the ointment, of course. Supposing competitors draw a bead on these carriers and shoot down the sales orders!

Your Glow Is Showing

The age of prehistoric rocks, pottery, ceramics, and lava flows can now be estimated by measuring their light-glow, a technique developed by a college professor. Approximate dates of objects up to 500,000 years old may be given, according to *Industrial Research Newsletter*. And then there is the college student, not on the beam, who signed up for the study of light-glow and was disappointed. He read it as night-glow.

For Heaven's Sake No More Shake

Development of electronic-computer analysis and laboratory test techniques have enabled Chrysler engineers to make giant strides in isolating engine vibration and shake from automobile passenger compartments, engineer Earle Stepp stated at an annual SAE meeting. And Stepp ought to know his stride.

The Tender Touch

An enterprising Eighteenth-Century English innkeeper placed at the foot of the stairs in his inn a box for coins labeled "To Insure Promptness." Thus the TIP originated, according to *Industrial Bulletin*.

Bye-Bye, Bounce

To study the effect of lining greaseless auto-chassis bearings with slippery Teflon fiber, Du Pont and a taxicab company cooperated in some research, according to *Industrial Research Newsletter*. Besides saving on lubrication costs, cabdrivers admitted that the rides were smoother with the Teflon job. Does this mean that cabbies have always been conscious of the bumpings in the back seats?

Baffled Brain

An electronic brain in a new Rhode Island post office became confused when Christmas seals appeared on the front of envelopes along with stamps, and rejected all those letters for hand canceling. To avoid a bottleneck during the seasonal rush, senders were asked to please put holiday seals on the backs of envelopes and not upset the brain.

Paging Planetary Pioneers

Describing the nuclear power plant at Camp Century on the Greenland Icecap, two engineers told a Boston convention of the American Society of Civil Engineers that their experience has led them to believe that "moon living" may become possible; that the first step has been taken in what may eventually lead to sustenance of life on the moon and beyond. The camp is located in an iceberg several thousands of feet deep. Take crosstown sled to third drift, skid right to tunnel entrance.

Lustrous Laundry

According to *Industrial Research Newsletter*, the Springfield, Mass., Armory has developed a method of reclaiming industrial diamonds from machine wiping cloths. They are washed in 1-pound lots in an ordinary machine with wire-mesh screening over a false bottom. The residue is infused with thallous formate and subjected to steam baths. Then liquid of 3.5 specific gravity allows diamonds to surface, free of associated abrasives.

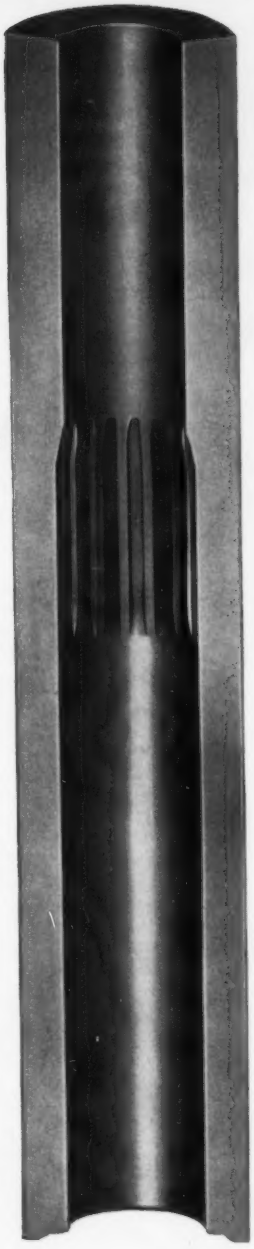
Close Tolerances
to ±0.0005"

Near Zero Concentricity
to ±0.0002"

Excellent Surface Finish
to 6-10 MICRO-INCHES

MIRROR-DUPLICATION AT HIGH PRODUCTION
WITH LOW-COST TOOLING...

CINCINNATI®
Intraform



HYPOID DRIVE PINION SHAFT

SAE 1040 Seamless Tubing

TOLERANCES:
± 0.0005"
CONCENTRICITY:
± 0.0005"
FINISH:
16 micro-inches
PRODUCTION:
100 parts/hr.

Internal areas produced by Intraform: two different size bores and blind spline.

STARTER CLUTCH HOUSING
SAE 1018 Steel

TOLERANCES:	± 0.0005"
CONCENTRICITY:	± 0.0002"
FINISH:	6-10 micro-inches
PRODUCTION:	260 parts/hr.

Internal areas produced by Intraform: involute helical spline; central bearing seat, four axial cam lobes.

For detailed information, write direct, or call in a Meta-Dynamics Division application engineer.

META-DYNAMICS DIVISION

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio

(New Developments in Shop Equipment—Continued from Page 180)

30 degrees negative. These ranges give every possible mathematical drill point that is practical for drilling metal, fiber, plastics, wood, and other allied materials.

The drill grinder features a 1-hp motorized 300-ampere electrolytic spindle; complete self-contained 8-volt, 300-ampere, direct-current power supply; constant electronic voltage regulator; automatic visual overload warning system; and self-contained electrolytic fluid systems. The total machine weight is 950 pounds, and the dimensions, 56 inches high, 38 inches wide, and 37 inches deep. The Power Pak is a variable 1-to-8-volt, 300-ampere, direct-current power converter. Employing a silicon diode rectifier, it has only two voltage control tubes, each with a 10,000-hour life guarantee. These maintain a preset voltage within 1/4 volt at amperes from 0 to 300 at the cutting wheel. The Power Pak is available separate from the drill grinder for use in other power-supply applications.

Circle 600 on Readers' Service Card

INSPECTION PROJECTOR MAGNIFIES FOR Ⓡ QUALITY...

Our inspection projector magnifies cutting edges to eliminate the minute angular deflection that could cause you costly production losses . . . just one of many inspections that account for Circle R quality.

CIRCLE R saws, slitters and combination center drills must submit to constant exhaustive inspection to work their way to you. They've got to prove they can ensure you correct cutting angles, long service, and minimal downtime.

Consult these CIRCLE R *Specialists . . .*

BURBANK — Production Mach. Sales Inc.
CEDAR RAPIDS — Midland Tool & Supply Corp.
CHICAGO — Donald Robertson & Co.
CLEVELAND — Production Tool Co.
DAYTON — J. R. Kontz Company
DETROIT — J. L. Bradford Associates
HACKENSACK — The Eaton Company
INDIANAPOLIS — Donald McIntire
MEMPHIS — Broach-Sherwin Tool Specialists
MILWAUKEE — Ford Tool Company
MONTREAL — Humphrey S. Watson
NEW HYDE PARK — The Eaton Company
NEW YORK CITY — J. V. Crommelin (Export)
PHILADELPHIA — General Tool Sales Co.
PHOENIX — McEugenia Tool Center
PITTSBURGH — Ralph Esposito & Co.
PROVIDENCE — Fred L. McMillan
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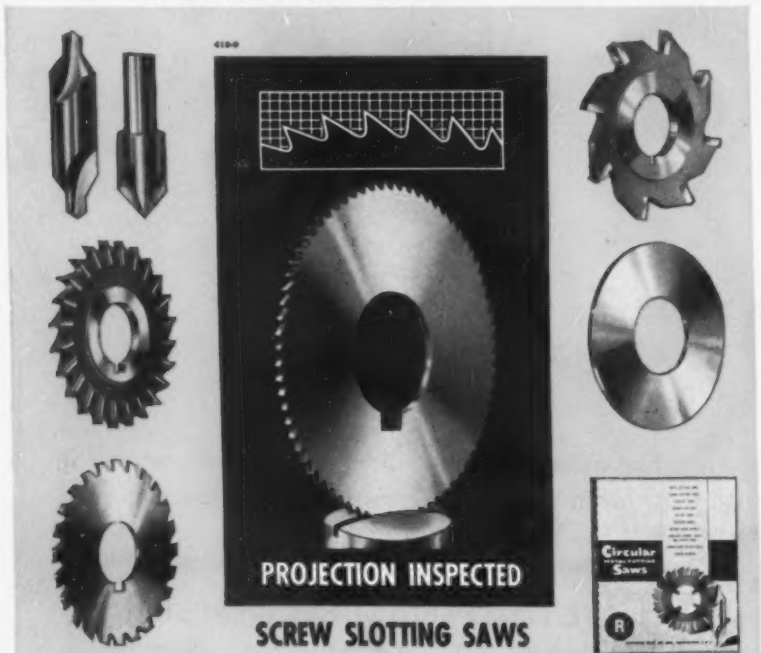
CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

METAL SLITTING SAWS • COPPER SLITTING SAWS • SCREW SLOTTING SAWS • COMMUTATOR SLOTTING SAWS • JEWELERS' SLOTTING SAWS • CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS • COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS



SCREW SLOTTING SAWS

Send for Catalog P Showing More Than 1200 Items

Cascade rinse unit

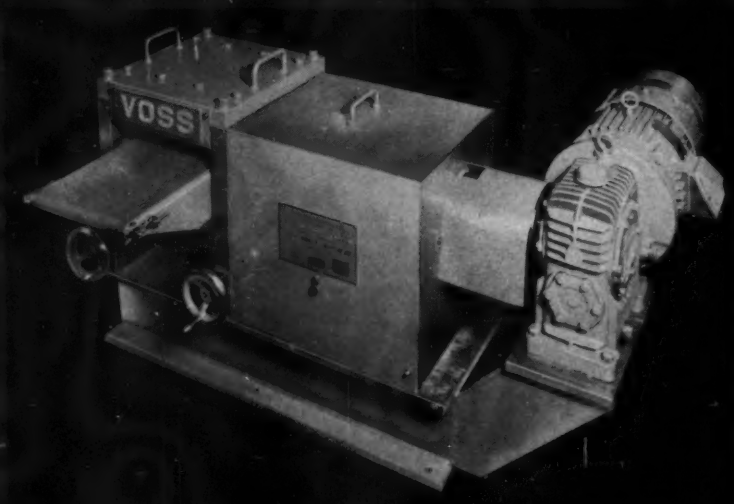
Cascade Rinse Unit for Cleaning Systems

The Pioneer-Central Division of the Bendix Corporation, Davenport, Iowa, has developed a three-stage Cascade rinse unit designed to complement its complete line of Sonic Energy cleaning systems. Three types of rinse units—spray, immersion, and cascade—are now available.

The Cascade unit has three rinse stations. The rinse solution is pumped into the first station, from which it overflows into the second, and subsequently into the third station, where it is drained off for rejuvenation and recirculated. Parts being rinsed are submerged in Chamber 3, followed by submersion in 2, and subsequently in Chamber 1, the cleanest of the three stations. After rinsing, the parts are normally dried in a forced air dryer.

The rinse cabinet shell is constructed of No. 18-gage mild steel with gray hammerloid finish. The tanks and top are No. 14 gage Type 302 stainless steel. Cascade rinses are available with three 14- by 12-inch or three 18- by 25-inch chambers.

Circle 601 on Readers' Service Card



New Parts-Flattener Ups Production Speeds 1,000% Or More . . .

Bold statement? Yes! True? Yes! In some of its present applications, two Voss flatteners and a few operators have replaced hundreds of workers assigned to hand flattening.

Principles of Voss Roller Leveler Applied—An adaptation of the Voss precision Roller Leveler, considered the Cadillac of its class, the flattener operation is based on a series of small diameter work rolls supported by multiple back-up bearings. Parts are worked to relieve stresses, achieving within .005 of dead flatness in one pass.

Reliability Built In—One of the important characteristics of the Voss Roller Leveler is its reliability and minimum downtime. The flattener shares these qualities. Rugged construction of the machine insures a long and productive life.

Hand Feed or Automatic
The flattener is available either way. Most models are compact enough to sit on a desk top. The machine will handle an extremely wide variety of flat stamped parts. It can also be engineered to flatten parts having irregular surfaces.

Let Voss help you to automate your parts-flattening. Call or write today.

We'll be glad to arrange a demonstration with your parts, without obligation.

Voss ENGINEERING CO.

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For more data circle this page number on card at back of book

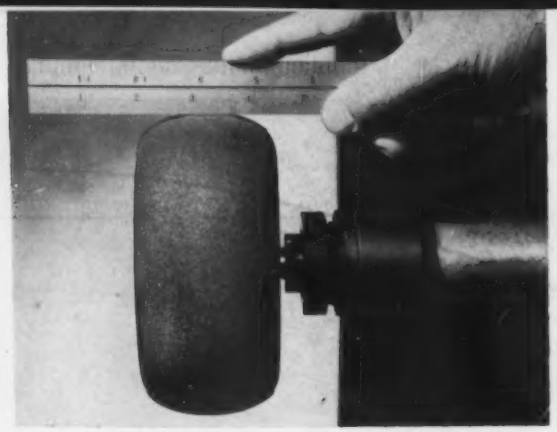
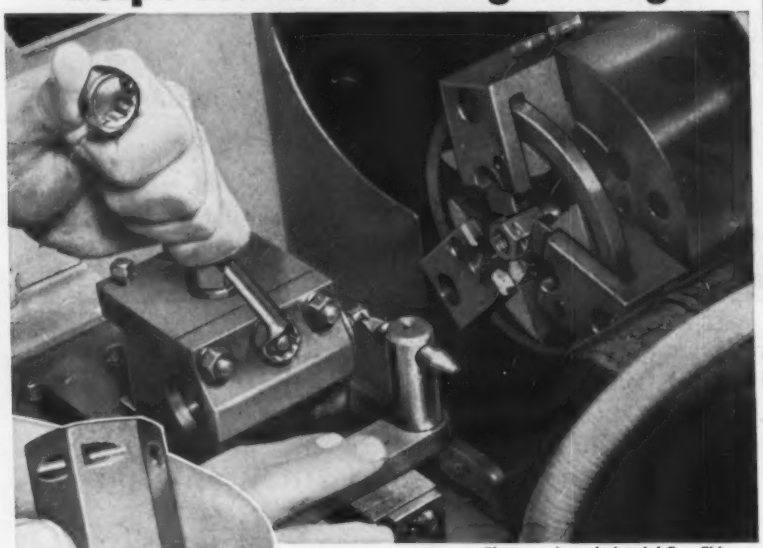


Fig. 1. A straightedge shows the degree of crown which can be developed in the new coated abrasive Kontoor bands when run on an inflated drum

Fig. 2. Coated abrasive Kontoor band crowned slightly, but enough to prevent edge cutting, when used on pneumatic grinder for finishing stainless-steel vessel

Buck chuck on Gisholt CRI-DAN helps make amazing savings



Photos — Acme Industrial Co., Chicago

Smart production 467% faster!

The problem: a 20 NF Class 3 thread up to shoulder in bore on hex end of 440C stainless spool valve. Tapping was slow, breakage excessive . . . hardening shrunk and distorted threads . . . rejects as high as 20%.

The solution: A CRI-DAN lathe with a Buck compensating chuck, with internal pilot bushing, to center and grip work instantly for automatic taper threading with .4675" go —.4701" no-go precision. Result: 5.03 *minutes saved per part . . . no rejects.*

In your shop, too, you'll make money *every* time you chuck with Buck.

FREE catalog write —

Makers of Scroll, Power, Dust Proof, Independent Chucks.

BUCK TOOL COMPANY

320 SCHIPPERS LANE • KALAMAZOO, MICH.

Self-Crowning Abrasive Contour-Grinding Bands

Coated abrasive bands and belts which assume any desired degree of crown when run on inflatable rubber drums have been developed by the Behr-Manning Co., Troy, N. Y., a division of the Norton Co. Suited for both stock removal and polishing, these new products are recommended for offhand work in confined areas, and particularly on concave or other contoured surfaces. Their crowned shape eliminates the edge cutting that occurs when a flat band is inadvertently tilted, permits accurate grinding on extremely narrow areas, and diminishes chattering when operated at low pressures.

They are made of aluminum-oxide abrasive in grits 40 through 180 on X-weight cloth, bonded with all-resin adhesives; they are designed for use on smooth-faced or serrated "Valcore" drums made by Nu-Matic Grinders, Inc., Cleveland, Ohio. Application for patent protection on the abrasive products has been made.

Bias-cut but not molded, the new bands assume a crowned shape when the pneumatic wheel or drum is inflated, as shown in Fig. 1. Once the crown has been generated, pressure may be reduced to match woodworking requirements. "Kontoor" bands are available in three sizes: 2 by 9 5/8 inches for the Valcore Model 320-C, with maximum speed of 6000 rpm; 2 1/2 by 15 1/2 inches for Model 525-C, with 4500 rpm maximum; and 2 by 19 inches for the 620-C, not to exceed 4000 rpm.

These bands will not take an

(Continued on page 199)

HOW ELSE WOULD YOU MAKE IT?

plus .0005" minus .0000"

These are some of the *cast* tolerances on this complex mounting frame. GE design engineers specified Zamak—"because of the close tolerances we needed and could get...***without machining.***"

Close tolerances are only one reason Zamak was specified. This mounting frame provides the proper dimensional relationship between many critical components used in the instrument. It must be dimensionally stable to insure continued accuracy; it must withstand heat, humidity, sand, dust and salt spray; it must take rugged, day-in, day-out use. "***It could only be done in zinc,***" says the die caster, Peasley Products, Inc.

GENERAL ELECTRIC AMMETER-VOLTMETER FRAME

AWARD OF MERIT

THE NEW JERSEY ZINC COMPANY'S "ZINC DIE CASTING OF THE YEAR" CONTEST

Cost? The answer from GE design engineers: "This die casting has permitted us to supply the market with an instrument whose performance is equal to, or better than, previous designs, and at the same time has reduced cost through greatly reduced machining operations."

Zamak gives you more for less. How else would you make it?

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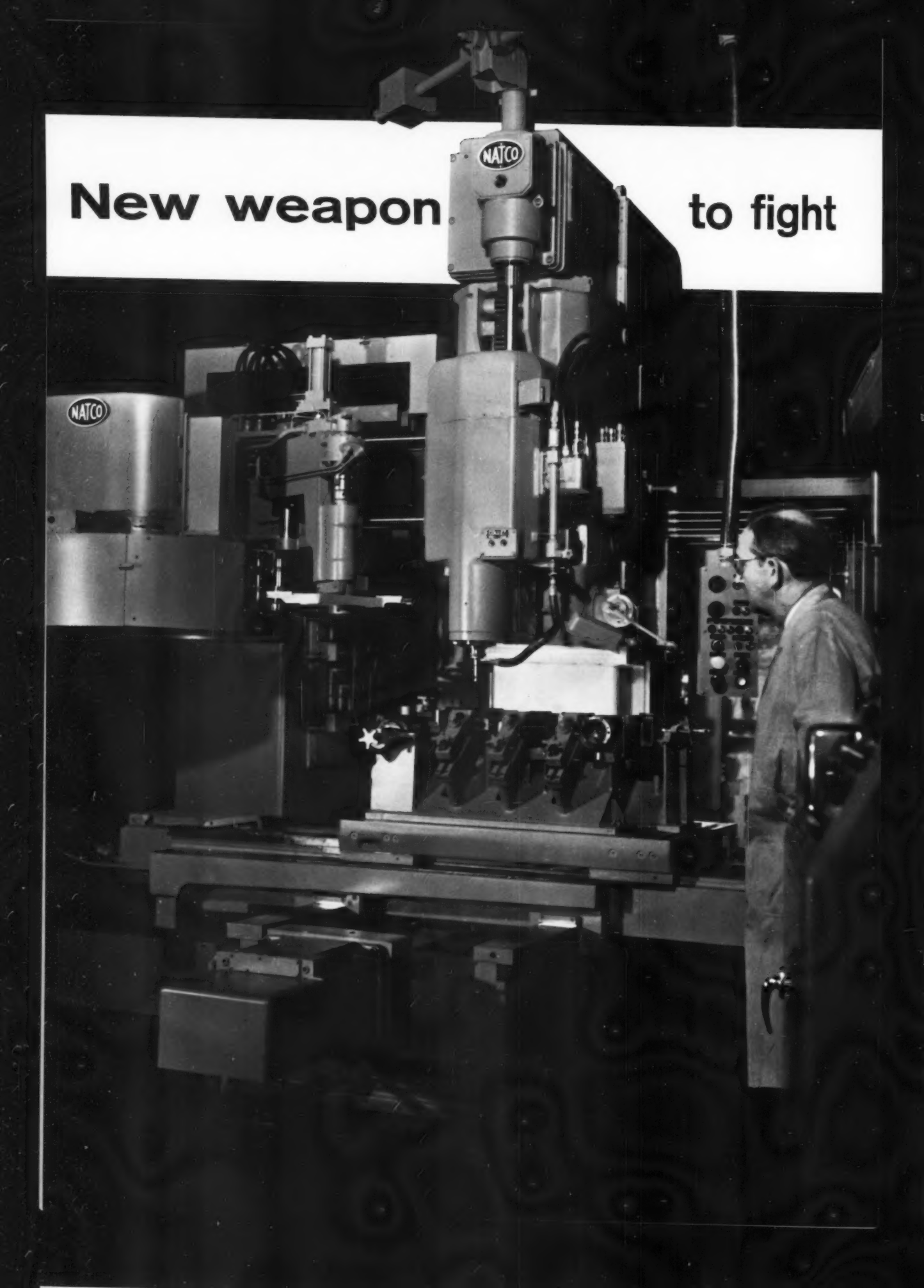
HORSE HEAD PRODUCTS


New weapon
to fight
NATCO
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profit squeeze

Start profits on the upswing by wringing the water out of drilling, tapping, and milling costs. This new Natco Drilling-Tapping-Milling Machine—with Automatic Tool Changing and Natcotrol—is just the machine to do it.

Virtually eliminate jigs and fixtures, chop parts inventory, hold lead time to hours instead of weeks, cut your scrap rate to the vanishing point, know your costs in advance—these are the kind of savings available to you through Natcotrol—Natco's own fully electro-mechanical numerical control system.

Time wasted at the tool crib? Not any more with Natco's automatic tool changer that works without tool coding, and always holds the next tool ready for quick changing.

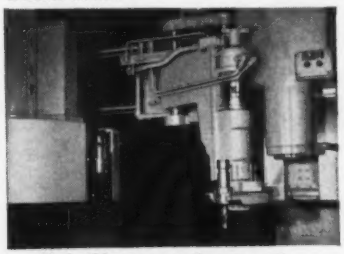
More reasons for putting Natcotrol and the Natco Automatic Tool Changer to work with Natco's powerful new Drilling-Tapping-Milling Machine, cutting your costs and widening your profit margin: Big work area, full numerical control of spindle depth and tool changing as well as table positioning, 50 - 3000 rpm, 2000 lb. thrust, 10 seconds tool changing time, 16" stroke, fast positioning, ±.001" accuracy.

Get us started on a quote for you today. There's a Natco representative in your territory ready to talk business. Write for bulletin No. 157-2.

NATIONAL AUTOMATIC TOOL CO., INC.
Richmond, Indiana

NATCO

Changer arm rotates to bring new tool into position. While new tool is operating, tool presenter will index to receive old tool.



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exact shape; instead, their degree of crown will depend on grit size, air pressure in the drum, the drum speed, and the pressure exerted on the work. The grinding station should have an air outlet with pressure reducer, air hose, and a nozzle type air gun for inflating the drum.

Circle 602 on Readers' Service Card

Heliarc Torch Performs Both Welding and Cutting Operations

The major portion of the standard line of Heliarc (Tig) welding torches made by the Linde Company, division of Union Carbide Corporation, New York City, can now be used for both welding and cutting. Complete fabrication, from cutting of metal to final welding into a finished product, can be accomplished with a single Heliarc torch. Either manual operation or mechanized fixturing can be used.

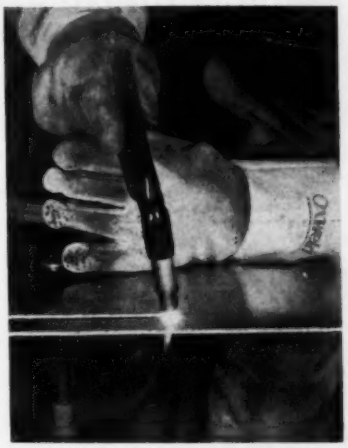

Fig. 1. Standard Heliarc welding torch HW-18 used for both tungsten inert-gas welding and cutting

Since Linde introduced the first tungsten-arc process, Heliarc welding, in 1943, this company has continued to develop the tungsten-arc concept, especially with the object of producing an improved cutting process. This object was achieved through the economy, speed, and ease-of-operation of a new process called "Constricted Arc" cutting, introduced in 1955. In this process (see Fig. 2) the intense arc, protected by an inert-gas shield, is transferred from a tungsten electrode to the work-piece. Prior to reaching the work-piece, however, the

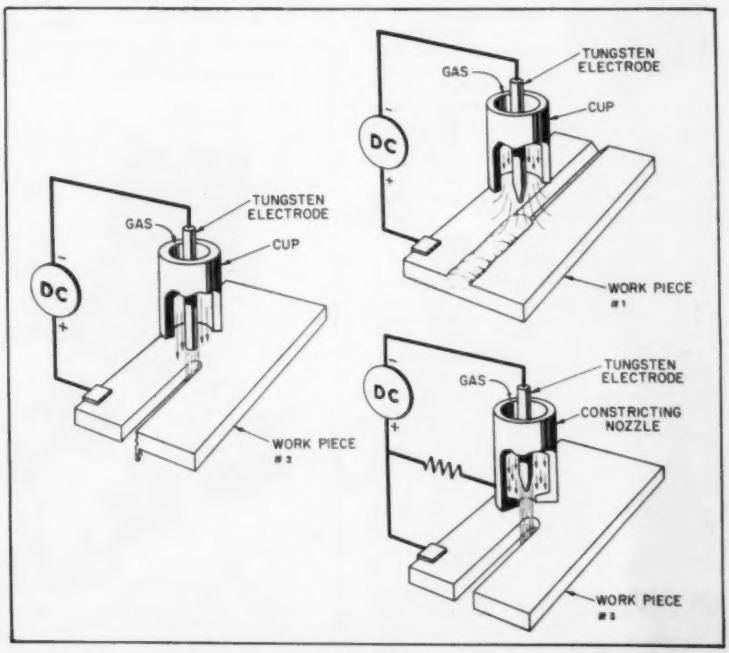

Fig. 2. Schematic comparison of the three basic Tig processes developed by the Linde Company: Heliarc welding, No. 1; Heliarc cutting, No. 2; and Constricted Arc cutting, No. 3

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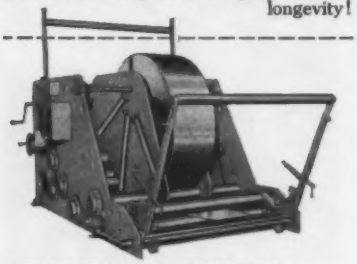

BENCHMASTER KOIL-KRADLES
Rotates coil stock on powered rollers, supplies a slack loop from which any machine can draw. Eliminates need of pulling against the weight of a heavy coil. Improves feeding speed and accuracy of parts. Sizes to 20,000 lb. capacity, 50" coil widths. Available with/without pinch rolls.

BENCHMASTER STRAIGHTENING MACHINES
Powered rolls remove moderate twist, curl and camber; flattens and straightens stock for easier feeding and better parts. Also available as COMBINATION STRAIGHTENING and FEEDING MACHINES or as KOIL-KRADLE STRAIGHTENER COMBINATIONS. Coil widths to 50", thicknesses depending on material specifications.

BENCHMASTER PUNCH PRESSES
Made in 2, 5, 8 and 10 ton capacities in plain OBI, Back-Geared, Fixed Bed Gap Frame, Deep Throat, Gang and Half-Press types for all high speed production requirements. Choice of air, electro-magnetic or mechanical clutches.

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arc is constricted in a narrow orifice at the end of the cutting torch, creating a high-velocity arc that easily melts and forces a narrow kerf through both ferrous and nonferrous metals.

In contrast to the Constricted Arc process, the Heliarc cutting method utilizes the tungsten electrode and the inert-gas shield, but does not constrict the arc. Hence, the same torch can be used to either weld or cut most common metals, particularly aluminum, magnesium, copper, aluminum bronze, and stainless steel. Cutting is accomplished by increasing current density above good welding conditions, while utilizing Linde argon-hydrogen shielding mixtures. Normal gas flow rates (40 to 60 cubic feet per hour) are sufficient to transfer energy across the arc and displace the molten metal. Good kerf quality is obtained on one side of the cut, while the other side is trimmed away as scrap. Simple scratch starting is employed and arc length is not critical. Any standard direct-current power equipment with a 70-volt open circuit may be used for Heliarc cutting of metals within a thickness range of 1/8 to 1/2 inch. Typical Heliarc cutting speeds are 40 to 60 ipm on 1/8-inch aluminum and 20 to 40 ipm on 1/8-inch stainless steel, using Linde H-35 shielding gas.

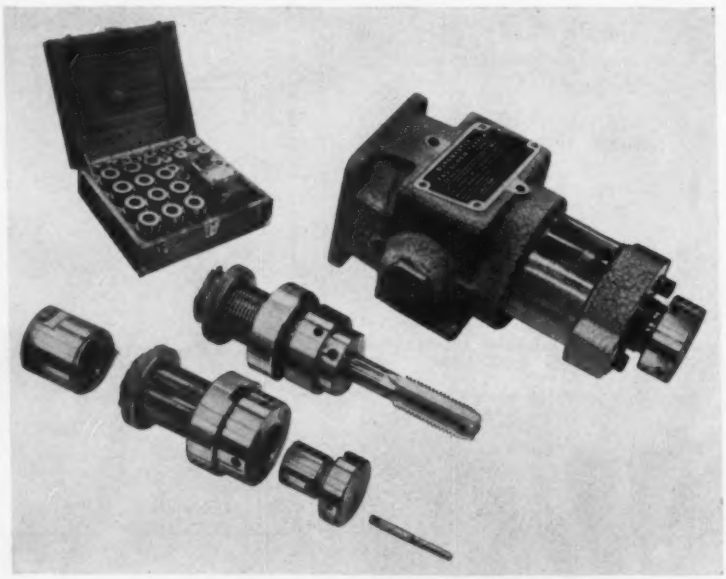
For critical fabrication, particularly on high-production schedules, Constricted Arc cutting continues to provide the highest cutting speed and quality. Constricted Arc cutting will slice any thickness of metal between 1/4 and 4 inches. With this method of cutting, both sides of the cut are normally dross-free and have excellent kerf quality. Mechanized Constricted Arc cutting speeds are as high as 1000 ipm. Straight lines, bevels, circles, and shapes are cut with equal ease on either single thickness or on stacks of sheets. But for the fabricator who needs the speed and quality of inert-gas cutting, though not the extremely high speed and quality of Constricted Arc cutting, Linde now offers Heliarc cutting with Heliarc welding torches.

Circle 603 on Readers' Service Card

Burgmaster "Leadmatic" Lead-Screw Tapping Head

A Burgmaster "Leadmatic" tapping head brought out by the Burg Tool Mfg. Co., Inc., Gardena, Calif., is said to greatly improve the finish and accuracy of tapped threads and to eliminate scrap due to pulled or loose threads. The drive runs in ball bearings, and the engagement of forward and reverse motions is through multiple-tooth, positive

(Continued on page 204)



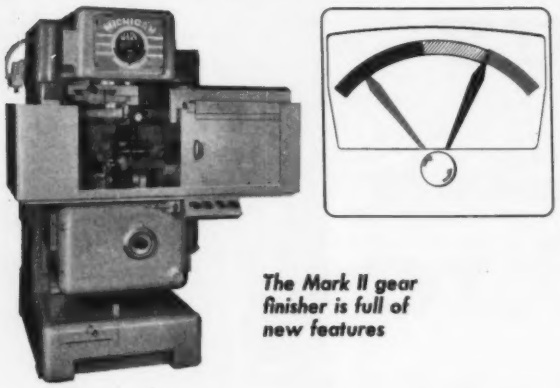
Leadmatic tapping head introduced by Burg Tool Mfg. Co., Inc.

NO. 2 IN A SERIES

SOLUTIONS TO GEAR PROBLEMS

WANTED: AUTOMATIC WARNING WHEN SHAVING CUTTERS ARE DULL

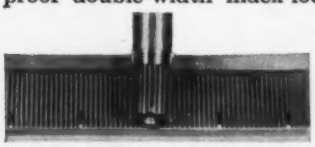
This has been solved in the new Mark II gear finisher. An indicator connected to the cutter drive circuit registers power required to drive the cutter, warns when preset 'dullness' is reached. Device also protects against cutter breakage by dropping the machine knee or warning if an oversize gear should be loaded into the machine. Ask for Bulletin 870-60.

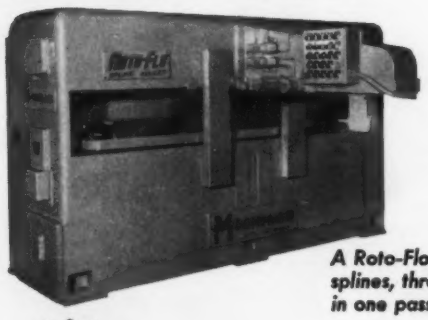


The Mark II gear finisher is full of new features

WANTED: A SIMPLER WAY TO PRODUCE SPLINES 'FOOLPROOF' IN ASSEMBLY

Such splines can be produced without additional operations or time on Roto-Flo machines. A foolproof double-width index-locating spline tooth is created simply by grinding off one end of the forming rack teeth at the locating point. Incidentally, the Roto-Flo produces such a spline in just a few seconds. Ask for Bulletin RF-60.

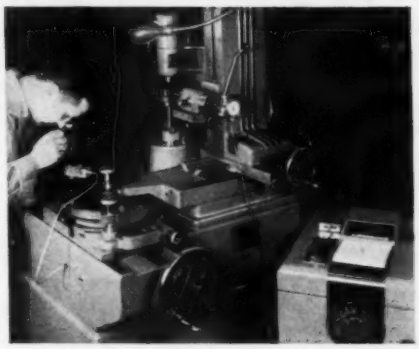




A Roto-Flo produces splines, threads, grooves, in one pass

WANTED: A WAY TO GET RID OF SETUP AND 'FEEL' ERRORS IN INVOLUTE CHECKING

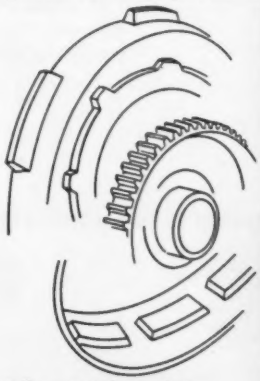
To answer this, we now have available an optical attachment for setting the sine-bar on ANY Michigan Tool #1124 involute checker. Remarkably fast and provides greater setup consistency for increased accuracy. Ask for Bulletin 1124-60.

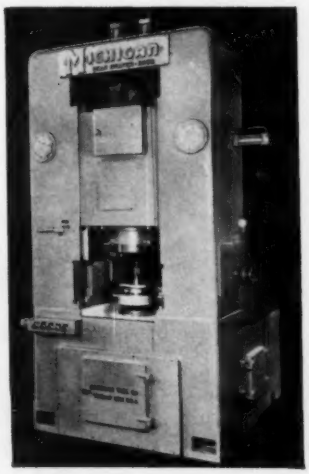


Fast optical sine-bar setting on an 1124 involute checker

WANTED: A SINGLE PROCESS FOR CUTTING ALL KINDS OF INTERRUPTED TOOTH FORMS IN DIFFERENT MATERIALS

We already had the answer to that: the Shear-Speed gear shaper. This machine will cut practically any peripheral shape—spur involute and straight teeth, interrupted or not, cam forms, ratchets, etc., in steel, cast iron, aluminum, and even plastics—in a small fraction of the time required by other processes. Ask for Bulletin 3000-60.





(above) A few of the many shapes produced in one plant by the Shear-Speed

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- Two large wrench flats on rod are standard—additional flats available on request.
- Fully meet JIC specifications.

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Standard Models for Operation to 3000 psi

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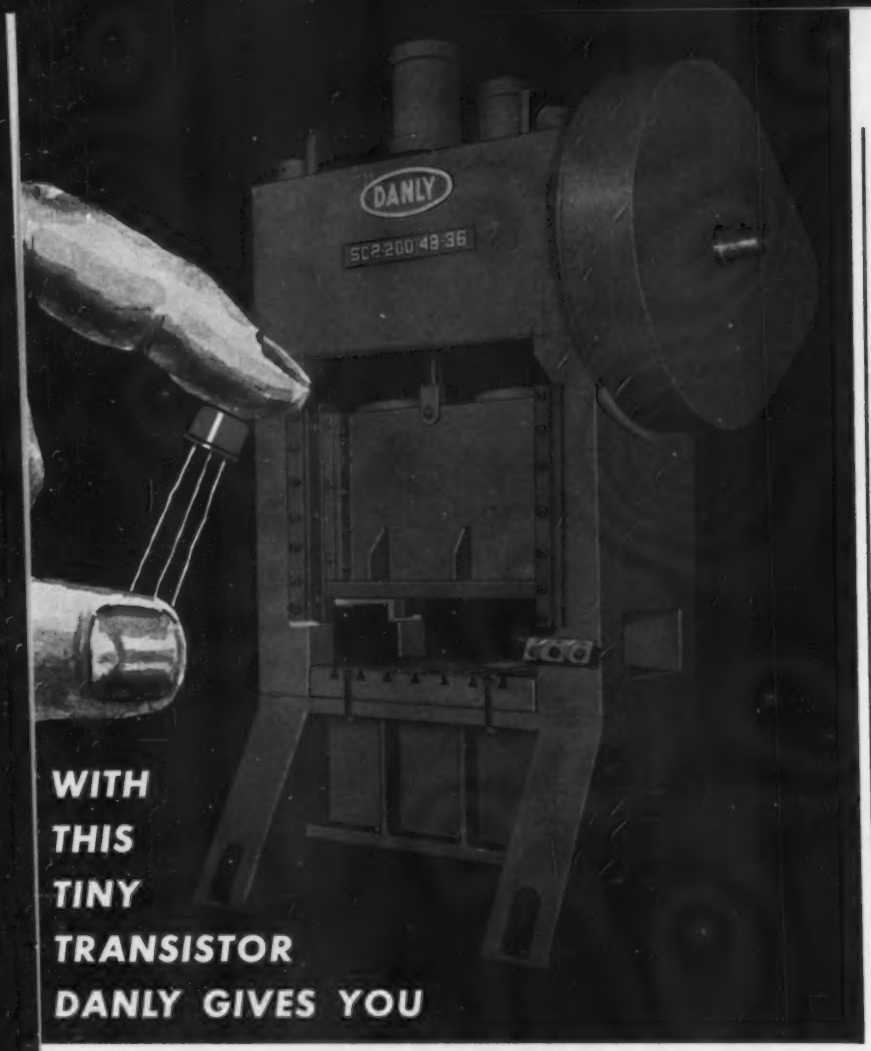

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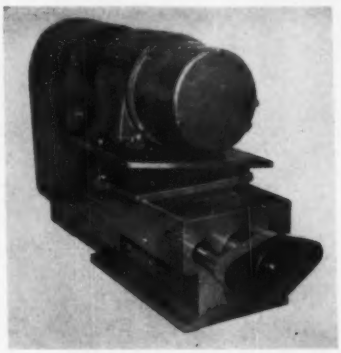
jaw clutches. Quickly interchangeable lead-screws are available for NF and NC threads from 1/8- through 1-inch diameter. The head is sold with one lead-screw, lead-nut, and tap collet as standard, with lead and collet diameter as desired

Especially suited for tapping tough materials and blind holes, the unit is furnished with a timer that allows tapping to depth and tap retraction from the hole. The shafts, lead-screws, gears, and collets are made of tough, wear-resistant alloy steel, hardened, tempered, and precision ground. These tapping heads are designed for use on single-spindle equipment and Burgmaster turret drills.

Circle 604 on Readers' Service Card

Precision Heavy-Duty Tapping Unit

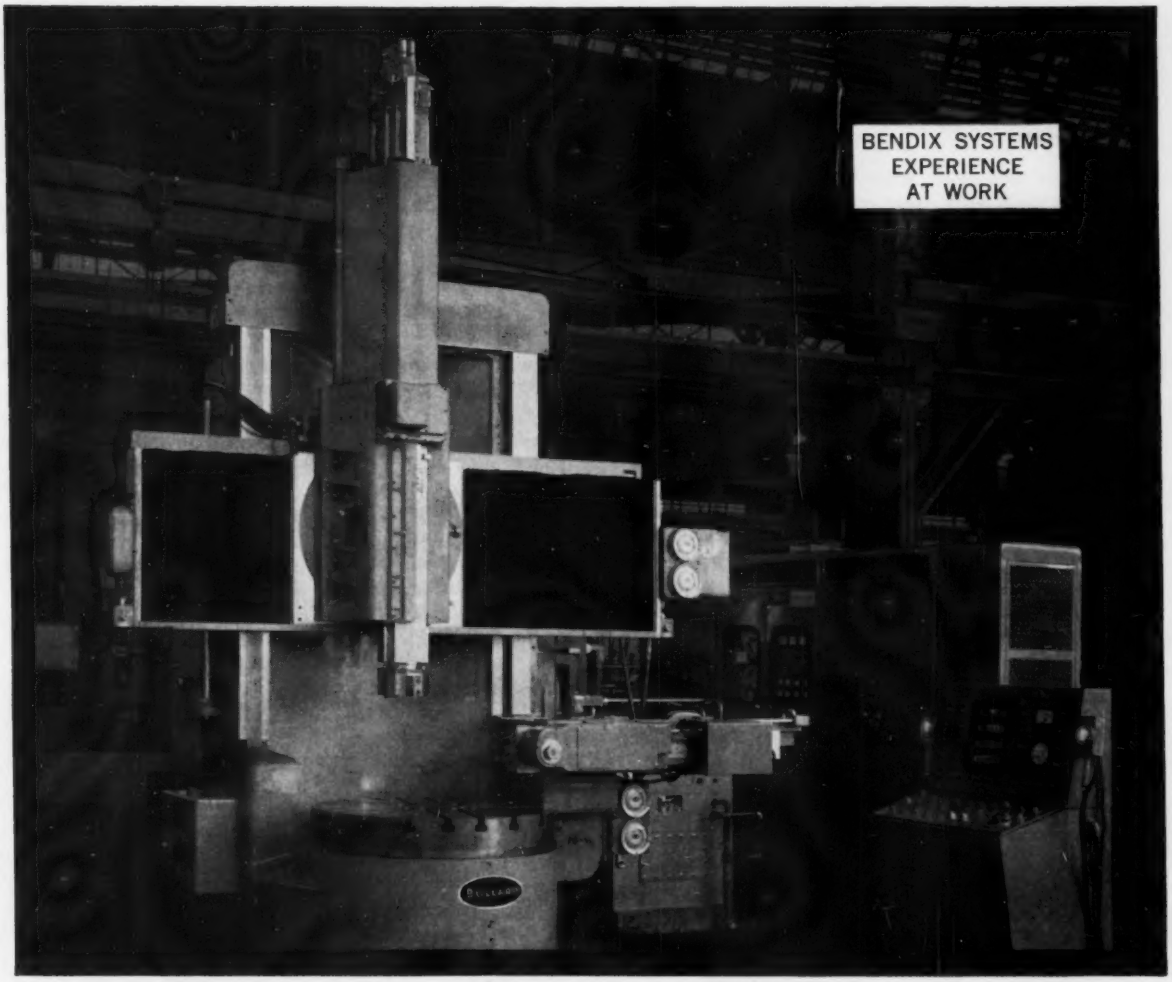
A precision heavy-duty tapping unit has been announced by the Johnson Drill Head Co., Rockford, Ill. This compact TU 1400 unit measures only 32 inches in length, 10 15/16 inches in width, 22 1/2 inches in height, and may be supplied with motors up to 10 hp. It has a 6-inch maximum spindle travel, and can be used in any position, making it well adapted for multiple-station arrangements on fixed and indexing tables.



Johnson heavy-duty tapping unit

Built-in electrical relays allow automatic or manual cycling. Each unit is provided with its own control panel and is capable of 30 reversals per minute. It is equipped with oil reservoir tank and a lubricating pump that assures proper lubrication.

Circle 605 on Readers' Service Card



BENDIX SYSTEM ENGINEERING PROVIDES OPTIMUM NUMERICAL CONTROL FOR TURRET LATHE

Shown above is a Bullard four-axis vertical turret lathe equipped with Bendix DynaPath-14 contouring control unit. In this application, the selection of tools and spindle speeds is programmed, as is the motion of both slides.

Bendix application engineers, with accumulated experience in mechanical and hydraulic analysis of machine tools, worked closely with Bullard to produce this wedding of machine tool and numerical controls. And Bendix systems experience gained in working on other contour turning applications (with such companies as Ex-Cell-O, Heald, and Giddings & Lewis) assures the user correct application of control unit to machine tool.

In addition to contour turning applications, Bendix engineers numerical control systems for milling, grinding, drilling and jig boring machines. We have developed and applied controls to 2-, 3-, 4-, and 5-axis systems, both continuous path and point-to-point. These controls are being used daily in plants across the country to increase machine tool efficiency, reduce lead times, and make parts of consistently high accuracy.

Bendix SYSTEMS EXPERIENCE can provide the key to your machine tool problems. The right Bendix numerical control unit can be the profit-maker you've been looking for. Start putting Bendix application engineering experience to work for *you*—write today for a copy of our catalog number 308.

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Eastern Malleable Iron Co., Naugatuck

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

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Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
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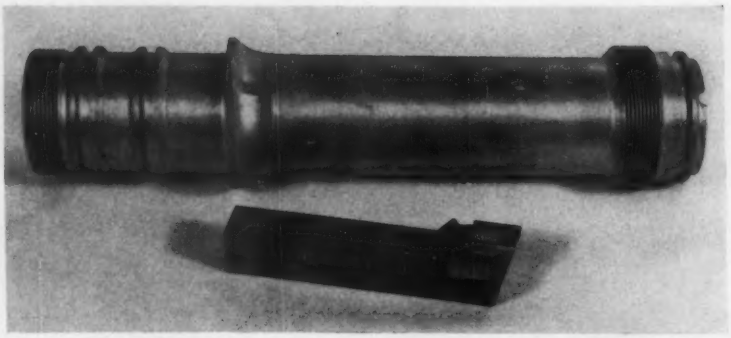


Steering cylinder used to control jet airliners on take-off and landing, and Carmet 606 cutting tool employed in machining the cylinder

Carmet Tungsten-Carbide Cutting Tools

The Carmet Division of Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., is producing a tough tungsten-carbide cutting tool, designated Carmet 606, which is a general-purpose finishing grade material for machining steel. It is ideal for fast finishing of tough jobs such as the rugged airliner part shown above the Carmet 606 tool in the accompanying illustration. Withstanding roughing cuts where cratering and chipping occur is an outstanding advantage claimed for this tool. The hydraulic-pressure steering cylinder for a jet-airliner nose control before take-off shown in the illustration is produced by the Menasco Mfg. Co., Burbank, Calif., for the Boeing Airplane Co. In machining this aircraft part, the cutting life of the Carmet 606 tool was found to be 25 per cent greater than that of tools previously employed.

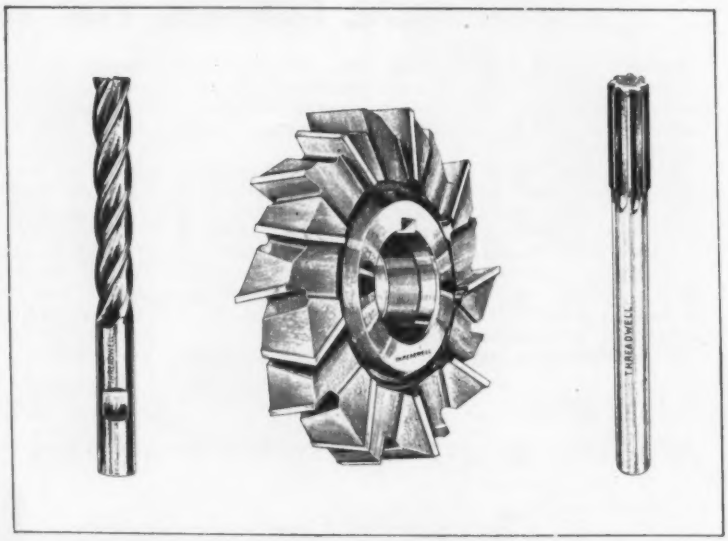
Circle 606 on Readers' Service Card

Reamers, End Mills, and Milling Cutters

The Threadwell Tap & Die Co., Greenfield, Mass., has introduced three complete new lines of cutting tools—high-speed end mills, milling cutters, and reamers—examples of which are shown in the accompanying illustration. These new cutting tools, together with the taps, dies, and gages made by the company, are available only through Threadwell distributors.

Circle 607 on Readers' Service Card

(This section continued on page 209)



High-speed end mill, milling cutter, and reamer recently added to metal-cutting tools made by the Threadwell Tap & Die Co.

Tool and Hardware Manufacturers Use Malleable for the Parts They Guarantee...

"Guaranteed Against Warping or Breaking" is the seal of quality often found on tools and hardware made of Malleable iron. Frequently Malleable components are guaranteed while the other materials in the same tools are not.

Proven performance superiority has induced many tool and hardware manufacturers to switch to Malleable castings so they, too, can guarantee their products. At the same time, they often reduce their costs. How? Because Malleable provides more strength per dollar than any other metal; Malleable is the most machinable of all ferrous metals of similar properties; Malleable is truly outstanding for its toughness, ductility, castability and corrosion resistance. While Malleable's natural appearance is attractive, a wide variety of finishes can be applied for added customer appeal.

Improve your products by using Malleable castings. Check with any Malleable producer that displays this symbol —

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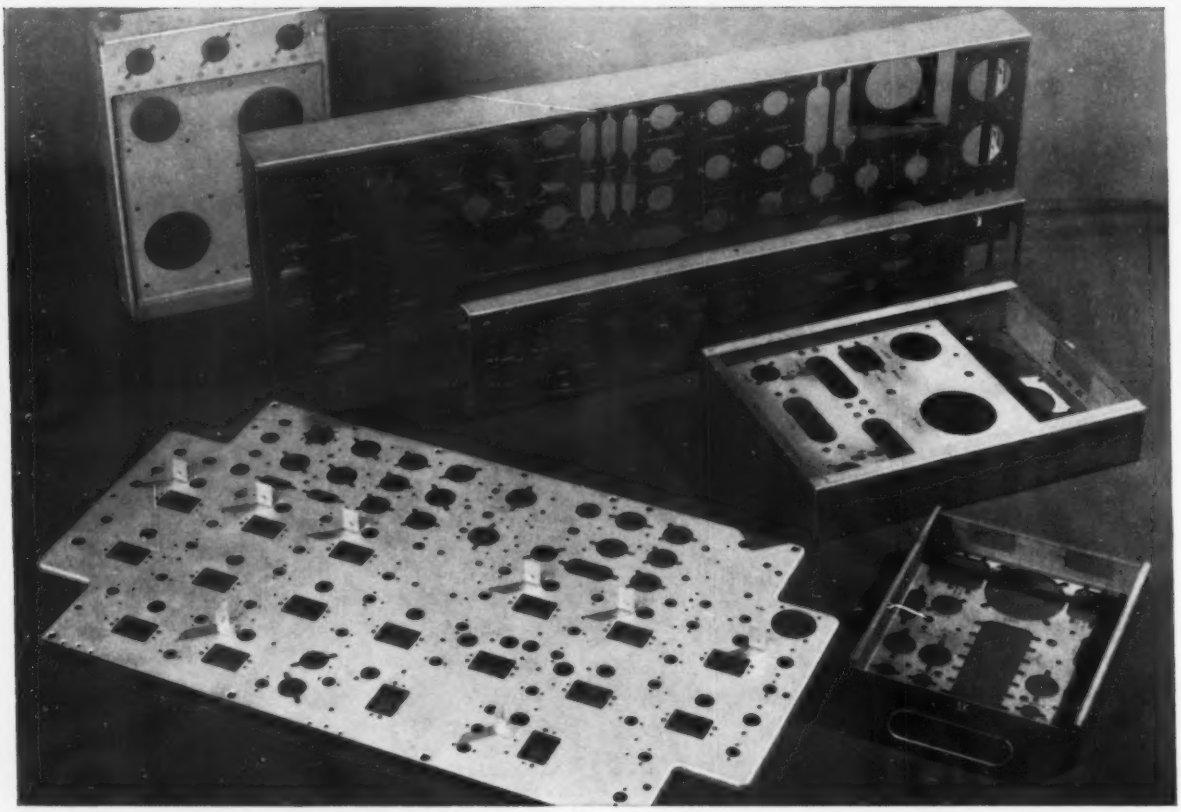
Profitmaking Ideas are yours free in our Data Unit No. 114, available from any member foundry, or Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

The manufacturer of this unit converted his entire line of machinist vises to Malleable... then guaranteed them against breakage. Not one claim has been made in three years!



PUNCH COMPLICATED PATTERNS FAST

With the new improved STRIPPIT 15-A Fabricator, complicated patterns of round and shaped holes can be produced quickly and accurately in sheet material. A high speed punch press that enables you to produce finished pieces directly from drawings, the versatile STRIPPIT 15-A eliminates slow "in-between" tool designing and die making... saves you days or even weeks of valuable time.

The STRIPPIT 15-A features a unique multiple-stop gauging system for positioning work to exact layout specifications. Punches and dies... within easy reach in built-in file drawers...can be switched from one size to another in less than 20 seconds. Designed especially for prototype and short production runs, the STRIPPIT 15-A is easily converted to a high speed production punching unit with the STRIPPIT Duplicator.

The STRIPPIT 15-A:

- **PUNCHES** any round or shaped hole up to 3½″ diameter. Maximum material thickness is ¼″.
- **NOTCHES** 90° corners—rectangular, radii, vee and special shape edge notches—up to ⅛″ capacity in mild steel.
- **NIBBLES** straight line or contour shearing up to 38″ diameter circle, at 165 strokes a minute, ⅛″ mild steel.

Send now for 15-A catalog. Free demonstration can be arranged right in your plant.

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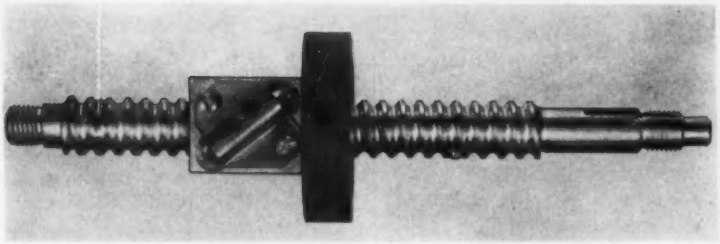
In Continental Europe: Raskin, S. A., Lausanne, Switzerland *In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England*



Freewheeling ball-bearing screw made by the Saginaw Steering Gear Division of General Motors Corporation

Ball-Bearing Screw with Freewheeling Feature

A new line of ball-bearing screws introduced by the Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Mich., permits limiting the travel of the nut at predetermined positions with continuing rotation of the screw. This freewheeling action is accomplished by providing a stop in the screw at each end of the desired nut travel, and a simple freewheeling device, which is an integral part of the nut assembly. There is no need for limit switches or other devices to limit travel and prevent jamming or stalling.

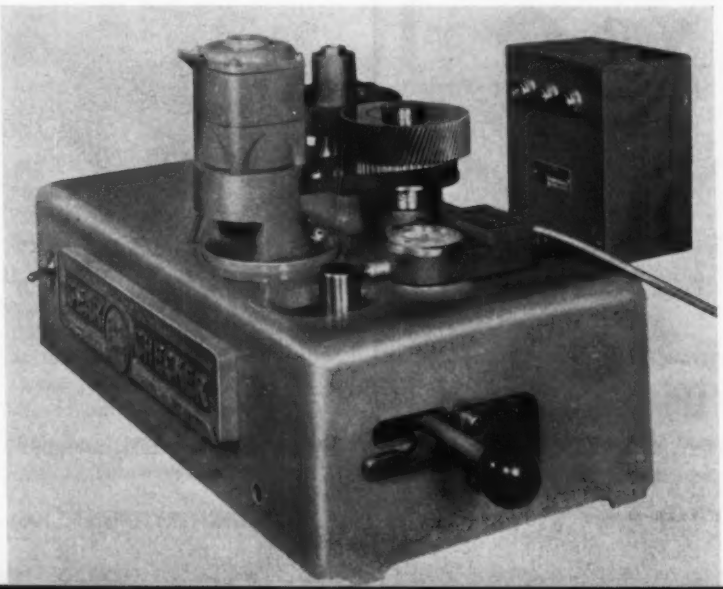
With the exception of the stops and freewheeling device, the units are the same as conventional ball-bearing screws and nuts. Also, the high load-carrying capacities of the units are the same as conventional screws of the same size. One unit having a ball circle diameter (pitch diameter) of 0.631 inch was tested for 45,000 cycles with a load of 500 pounds.

Circle 608 on Readers' Service Card

Low-Cost Gear-Rolling Inspection Fixture

A Red Ring Model GRH low-cost motorized gear-rolling fixture designed to perform precision production inspection operations on spur and helical gears is now available from the National Broach & Machine Co., Detroit, Mich. This fixture features an electric indicator and signal light arrangement that simplifies the problem of reading an indicator to determine if a gear is within specified inspection limits. A red light signal shows that a gear is above the specified center distance, and an amber light, that it is under the required dimension. A green light indicates a gear that is within the center distance inspection limits. If desired, an optional feature that will cause

Red Ring Model GRH motorized gear-rolling fixture that features an electric indicator and signal light arrangement



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Gusher Pumps contain no seals, pre-lubricated heavy duty ball-bearings reduce maintenance to a minimum.

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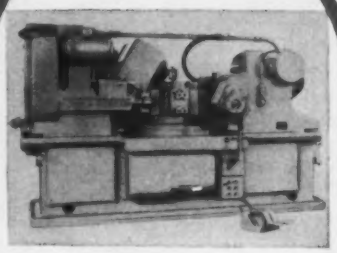
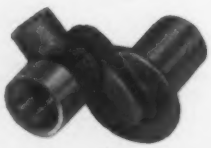
...and parts are finished without rehandling on

GOSS & De LEEUW AUTOMATIC CHUCKING MACHINES

The Goss & De Leeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worth-while gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & De Leeuw and only Goss & De Leeuw offers this feature in a standard chucking machine.





A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY PRODUCTION

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

either the red or amber light to glow for a preset time can be provided. This arrangement avoids the need for constant observation of the lights during inspection.

The electric indicator has a repeat accuracy of less than 0.0001 inch. Center-distance capacity of the Red Ring Model GRH gear-rolling fixture is from 1 7/8 to 12 15/16 inches.

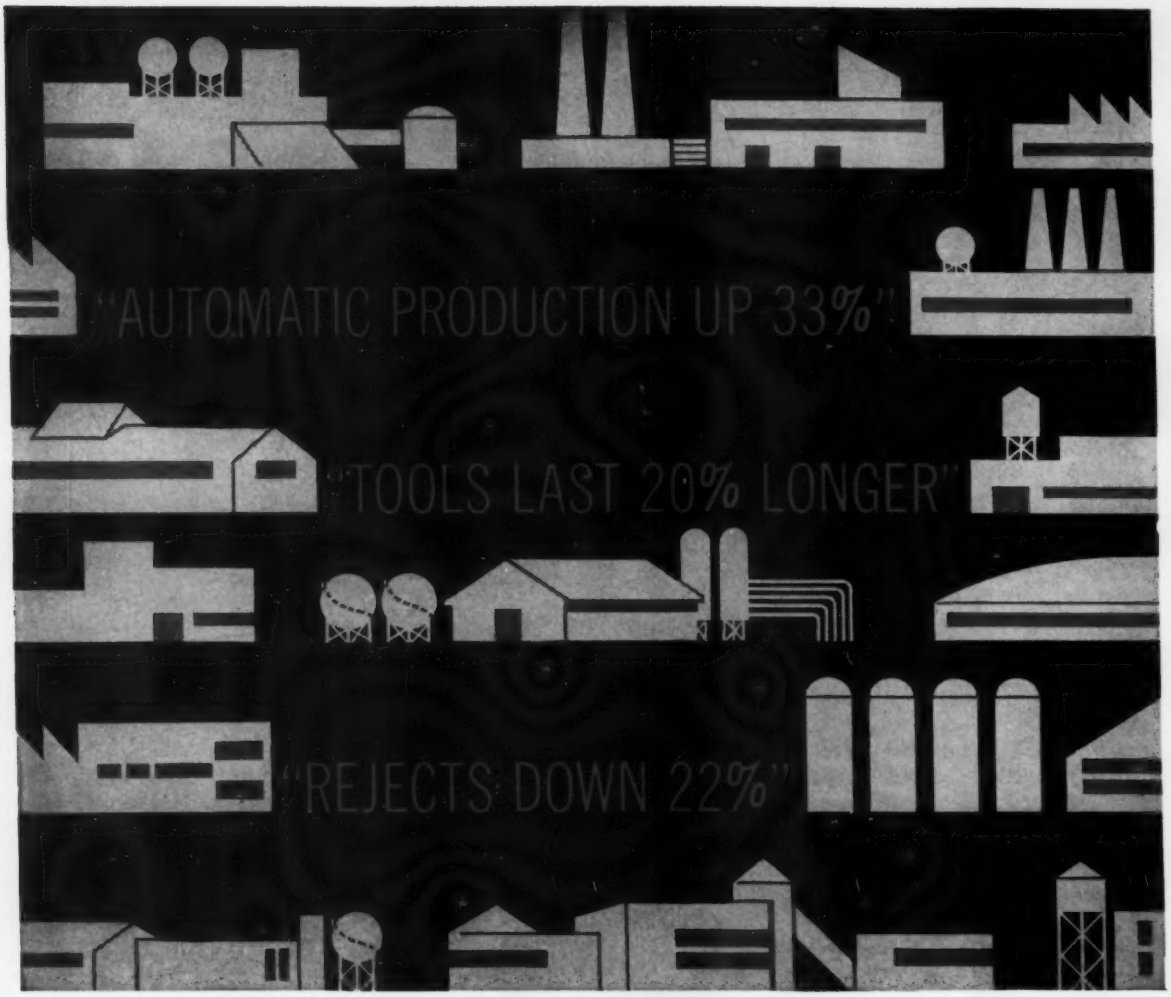
Circle 609 on Readers' Service Card

Cutler-Hammer Foot-Switches

Two completely new foot-operated switches with compact enclosures have been developed by Cutler-Hammer Inc., Milwaukee, Wis. Both the Type A standard-duty and Type C heavy-duty C-H foot-switches are designed for alternating- and direct-current pilot circuit control. The contact mechanism used in the devices is the long-lived Cutler-Hammer precision unit switch, which has single-pole, double-throw, twin-break silver contacts (normally open or normally closed) and is completely enclosed in a molded phenolic block. The standard-duty switch is of the two-position, spring-returned and front-treadle-operated type. Pressure on the treadle closes the normally open contacts, and release of the pressure opens the switch. The heavy-duty foot-switch contains two contact blocks and is operated by a side treadle. It has an NEMA 4 watertight enclosure with a die-cast aluminum case, cover, and treadle.

Circle 610 on Readers' Service Card

Foot-operated switches made by Cutler-Hammer, Inc.



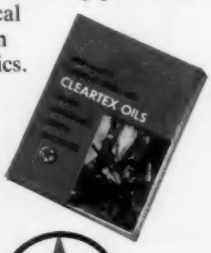
Why in the past 12 months hundreds of PLANTS HAVE SWITCHED TO CLEARTEX!

These automatic screw machine users have found that tri-purpose Cleartex has ended the problem of cutting oil dilution.

Manufacturers have found that in 7 out of 10 automatics, lube oil leaks into the cutting oil sump in spite of the most careful lubricating techniques. This diluted cutting oil can cause shortened tool life and piled-up rejects.

New Texaco Cleartex has solved the problem forever for many manufacturers. They now use Cleartex for both cutting *and* lubricating, hence the leakage that occurs no longer dilutes the cutting oil quality. The exceptional chemical stability and load-carrying ability of the Cleartex series make them equally suitable for use as cutting oils, lubricants and even hydraulic fluids.

TRY THE "CLEARTEX CURE" YOURSELF. Write today for Texaco's booklet—"Cleartex in Automatic Screw Machines." This illustrated guide will fill you in on the details, show you where you may be losing profits and how to avoid it. Or contact your local Texaco Lubrication Engineer for an authoritative study of your automatics. Just call the nearest of the more than 2,300 Texaco Distributing Plants or write to: Texaco Inc., 135 East 42nd Street, New York 17, New York. Dept. MA-62.



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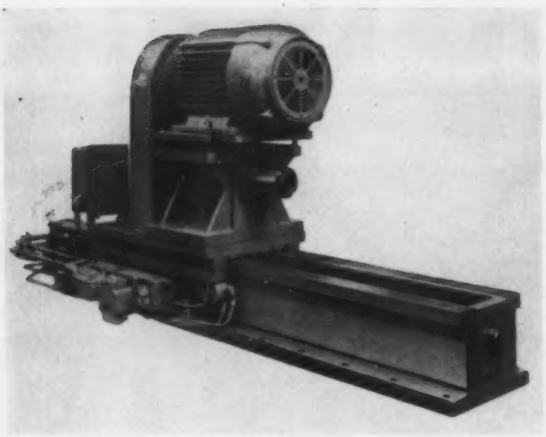
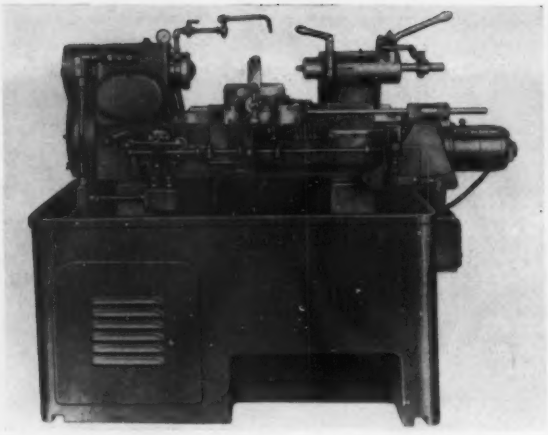


Avey self-contained Hydroway gun-drilling unit



Lipe Carbo-lathe being built by Burkhard Bros., Inc.

Gun-Drilling Unit

The Avey Division, Motch & Merryweather Machinery Co., Cincinnati, Ohio, has brought out a No. 4 Hydroway gun-drilling unit having a 36-inch stroke, timing-belt drive, complete self-contained hydraulic controls with control panel, and positive stop controls. The drill-capacity range of this unit is from 1/2 to 2 1/2 inches. Spindle speeds range from 1055 to 6900 rpm. Feeding rate is variable from 0.0001 to 0.025 ipr.

The high-speed, single-spindle gun-drilling head is ball-bearing-equipped, and has oil-mist lubrication with coolant inducted through the spindle, which has a 5/8-inch diameter through hole.

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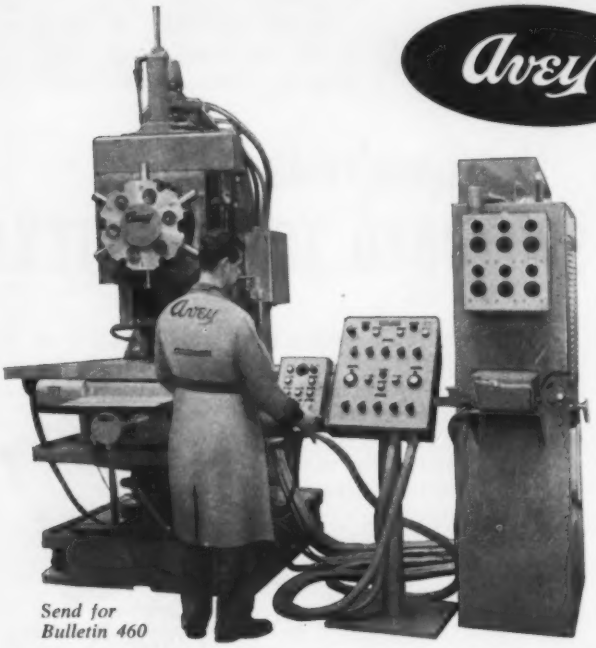
6 precision spindles by

Avey



Send for Bulletin 460

You can get this rugged Avey 250 Turret-Dex with either automatic or numerical controls. Rotary, 2- or 3-axis positioning. Pre-selected speeds, feeds, rapid advance, tapping cycles. Automatic depth control all spindles; automatic turret clamp; positive spindle stop; skip index. Capacity to 1¼". Eight spindles optional. Avey, Box 1264, Cincinnati 1, Ohio.

Carbo-lathe for Small-Lot or Long-Run Work

The Carbo-lathe formerly built by the Lipe Rollway Corporation, Syracuse, N. Y., is now being made by Burkhard Bros., Inc., Syracuse, N. Y. The complete work cycle of this lathe can be controlled electrically in combination with the air-operated front or back facer. Either a screw type or American Standard No. 5 spindle nose can be furnished. Spindle speed is variable from 95 rpm in the low gear to 3300 rpm on direct drive. The collet will take rod stock up to 1 inch in diameter. Work up to 18 inches in length can be handled between centers. Fixtures can be custom engineered by the manufacturer to suit specific requirements or they can be made by the user. Either manual or automatic control of the carriage is made available by a selector switch.

A push button starts the spindle and the carriage moves to the cutting position, automatically engaging the mechanical feed. At the end of the cut the feed disengages, the carriage dwells long enough to permit the tools to clear themselves, the spindle stops, and the carriage returns with tool relief quickly to the loading position. At any point in this cycle the operator can disengage and reengage the work with a manual control lever. A complete change of carriage-travel setup can be made in a matter of seconds by changing three adjustable stops.

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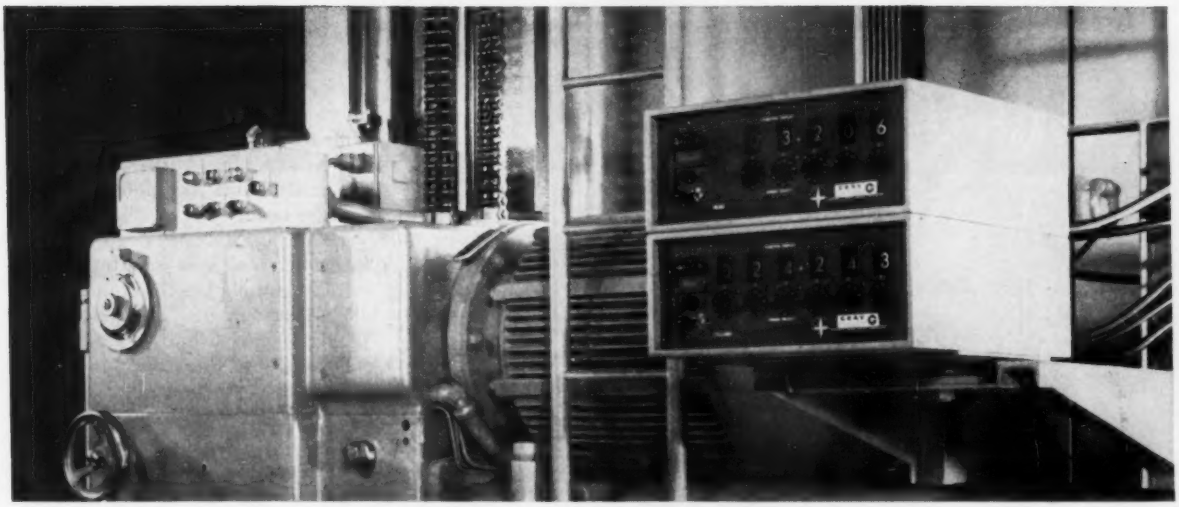
NORDEN Modumatic Control for New and Existing Machines

Series 100 features

- ☆ Actual Position Readout
- ☆ Decimal Display
- ☆ Full Range Origin Select



IF you have the time-consuming problem of rotary or linear positioning, then you are aware of the importance of knowing the exact location of the tool or the work piece. Up until now this was a tedious, time-consuming process requiring calculation and dial reading, both subject to human error. Norden's Series 100 display system eliminates all this and performs the calculations automatically. What's more, it can be installed on **new** and **existing** machines.

The Series 100 numerical control system utilizes a unique position feedback transducer, electronic circuitry and a visual display to indicate the **actual** position of the tool or work piece.

The **actual** position is displayed in straight decimal form by illuminated numbers that are readable from twenty feet. The display unit may be located on the machine or remote.

This Norden Modumatic system also offers a full range electronic origin select so that any desired offset can be quickly and easily dialed in by the operator on manual selector switches.

For more information about this position display system or other Modumatic control systems contact your nearest Norden Representative—400 Main Street, East Hartford, Connecticut, JAckson 8-4811, 11 West Monument Ave., Dayton 2, Ohio, BAldwin 8-4481, or write to us at the address below.

A new concept in Numerical Control from ★ **NORDEN** ★ **DIVISION OF UNITED AIRCRAFT CORPORATION**
DATA SYSTEMS DEPARTMENT
COSTA MESA, CALIFORNIA

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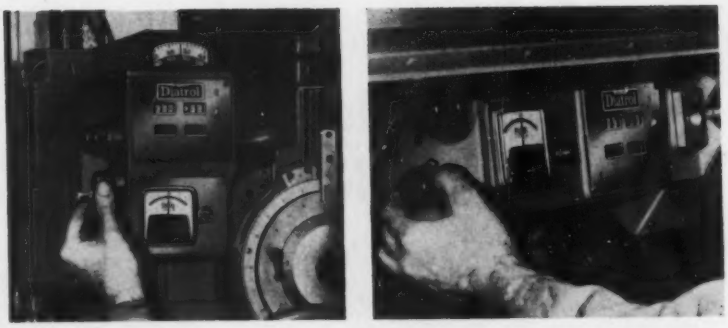
"Dial-In" Control for Machine Tools

An advanced development in machine tool control which eliminates much of the mathematics formerly required in setup work, especially that normally associated with accurate jig-boring operations, has been worked out by the DeVlieg Machine Co., Royal Oak, Mich. The accompanying illustration shows how simple it is for an operator to "dial-in" coordinate dimensions of a work-piece with



(Left) Dialing-in plus or minus dimensions that position jig-borer spindle vertically. (Right) Dialing-in horizontal settings of machine table

equipment built by DeVlieg for the new control system. The dimensions are being dialed directly from a print to a Jigmil through the measuring system worked out for the new system, called Diatrol. Two direct-reading dials provide a means of preselecting coordinate dimensions for horizontal table movement and movement of the spindle head.

Either positive or negative dimensions from any arbitrarily selected datum plane within range of the system can be dialed in. Then, pushing a button automatically positions the table and spindle head in seconds. While the machine is cutting, the operator can preset the controls for the next operation. The view at the left in the illustration shows how the operator dials in plus or minus dimensions to position the spindle vertically, and the one at the right indicates how horizontal settings of the machine table are dialed in. Shutters cover the minus set of figures when not in use to avoid errors through misreading. The measuring portion of the system also is capable of being calibrated to the ultimate in accuracy. The system is ideal for toolroom and experimental work, as well as jigless boring of small-lot jobs.

Circle 613 on Readers' Service Card

Lempco Hydraulic Press Brakes

Lempco Industrial, Inc., Machine & Tool Division, Bedford, Ohio, has announced a new line of hydraulic press brakes designed for sheet metal and plate fabrication. These machines, with capacities ranging from 75 to 1000 tons, employ a newly developed

PRODUCE 5 TIMES MORE PARTS
BURGMASTER Automatic 6-Spindle Turret Drill

● Shot pin fixture locator is shown projecting through table directly under the spindle. Color paths painted on template correspond to colors on spindle tooling as a visual aid for operation sequence.

Power Feed and Power Indexed Turret Speed Machining

● Meridian Metalcraft, Whittier, California, use a Burgmaster Automatic 6-spindle Turret Drill to machine several designs of Heat Exchangers for Instruments. In the setup shown, 60 holes in a range of three diameters are drilled and tapped in six minutes—five times faster than with former drill press methods. The simpler setup also saves 40% in tooling.

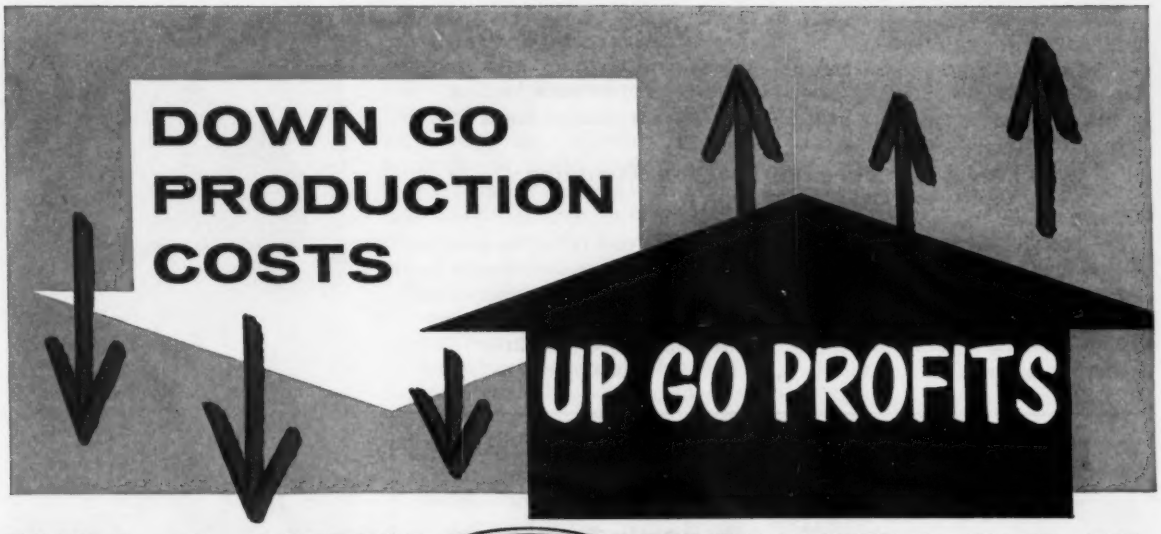
● Special mounting of the Turret Head on a Riveter C-frame provides 45" throat depth for widest utilization of this efficient setup. Bushings in the fixture bottom duplicate the hole pattern, and are sequentially engaged by an air-operated shot pin located in the table directly under the spindle. After hand shifting the fixture to approximate position (±1/16") as indicated by the template, the operator presses a hand-held control button to seat the shot pin and bring the fixture to exact position. The safely seated shot pin automatically initiates the spindle power feed cycle.

Sequence of Operations

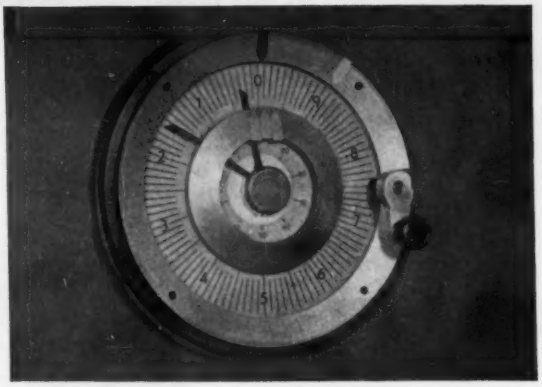
Spindle Number	Color Code	Tool	Speed
1	Red	Drill for #4-40 tap	1700
2	Black	Drill for #8-30 tap	1700
3	Green	Drill for #10-32 tap	1700
4	Red	Tap #4-40	900
5	Black	Tap #8-30	900
6	Green	Tap #10-32	900

● WRITE FOR FREE LITERATURE on Burgmaster Bench Model Turret Drills and Rapid Positioning Table. 1/4" drill and tap capacity in steel. Representatives in principal cities.

BURGMASTER CORPORATION
SMALL TOOL DIVISION—BURG TOOL MANUFACTURING CO., INC.
13001 S. Figueroa St., Box 311, Gardena, Calif. • Phone: FAculty 1-3310—Phone, wire or write Dept. O.6
World's largest manufacturer of turret-type drilling and tapping machines.

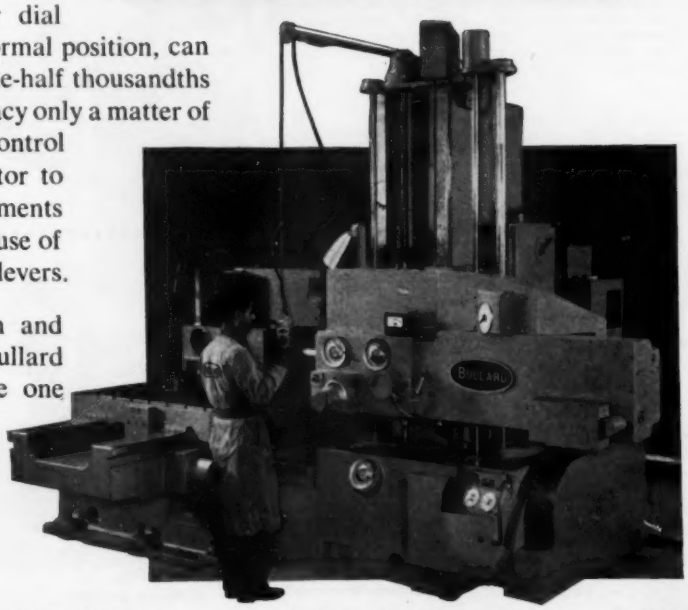


With the NEW BULLARD DYNAMILL H.B.M.



The controls, which have made it possible for Dynamill to reduce non-productive positioning time to a minimum, feature variable traverse rates recorded on large, clock-type dials, and controlled by Bullard's remote control pendant.

Head, table, saddle, and spindle each have a separate three-pointer dial which the operator, from his normal position, can easily read to an accuracy of one-half thousandths of an inch with further accuracy only a matter of simple interpolation. The remote control pendant allows the operator to traverse and position all elements under power without the use of handwheels, cranks or levers.



These and many other design and construction features of the Bullard Dynamill H.B.M. make it the one machine you

must investigate before buying any horizontal boring machine.

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

For more data circle this page number on card at back of book

mechanical-hydraulic valving device which eliminates the expensive electronic servo control required on earlier models. The new device is also said to offer a higher standard of accuracy even under severe eccentric work loading.

Circle 614 on Readers' Service Card

"Pineapple" Forming Tool for Machining Beryllium Parts

The Tool Engineering Section of Beryllium Corporation's fabricating plant at Hazleton, Pa., has developed a new type of forming tool, or formed cutter, for use on horizontal and vertical turret lathes. This tool is said to provide a faster, more accurate means for machining complex, all-beryllium parts and components for the aircraft and related industries.

Called "pineapple" tools because of their configuration, this family of formed cutting tools was designed by the Beryllium Corporation and built to its specifications by a large eastern tool manufacturer. Each pineapple tool consists of a high-carbon tool-steel shank 2 7/8 inches in diameter integral with a body of the same material, the work end of which holds six carbide-tipped cutters set at various rake angles, depending on the cutting requirements of the individual tool. The work end of the tool may be flat (180 degrees) or pointed (up to 70 degrees), depending on whether flat or conical shapes are to be cut. Holes ranging in size from 2 1/2- to 14-inch inside diameter, with wall thicknesses down to 0.25 inch, can be readily machined with the new tool.

Pure-beryllium metal part machined with pineapple tool in foreground

By changing the configuration, or "nose angle," of the pineapple tool, various shapes can be formed. Cutting speed for the aircraft parts shown in the accompanying illustration is 200 sfpm for the 5 1/2-inch inside diameter of the 3 1/8-inch deep hole, or a total of only forty-five minutes to form the completed part. This represents a saving of approximately two hours over conventional drilling or trepanning methods.

Circle 615 on Readers' Service Card

(This section continued on page 219)

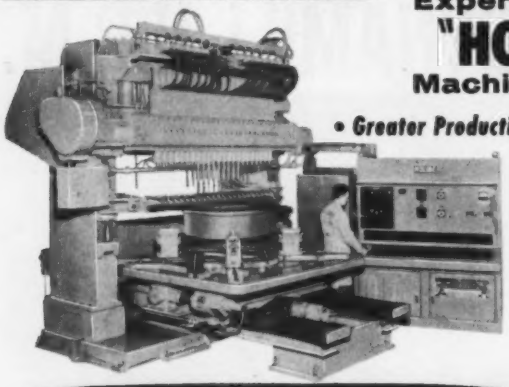
MOLINE

MULTI-NUMETRIC NUMERICAL CONTROL

(AS APPLIED TO MULTIPLE SPINDLE DRILLING)

Expertly Designed "HOLE HOG" Machine Tools for—

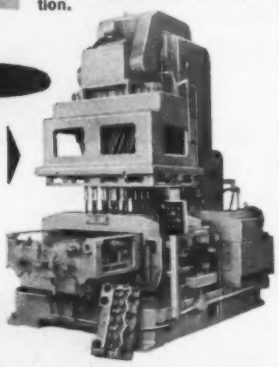
• Greater Production • Efficiency • Savings!

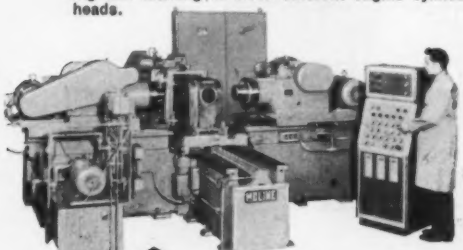


Model HD68 Tube Sheet Drilling Machine with Multi-Numetric Numerical Control for positioning of machine table in two directions and for selection of spindles. Information on punched tape permits automatic drilling of a complete hole pattern in a tube sheet without interruption.

OTHER MOLINE COST REDUCING EQUIPMENT

Model HU111 Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.





Model MR148 Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.

HD13 straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

60 years of Machine Tool Engineering Experience is at your service for

114

• Multi-Spindle Boring • Single and Multi-Spindle Honing
• Straight Line Multi-Drilling • Adjustable Spindle Drilling
• Special Multiple Operation Machine Tools *Write for Details*

MOLINE TOOL CO. MOLINE, ILLINOIS

MOLINE TOOL COMPANY

104 25th STREET • MOLINE, ILLINOIS

Representatives in principal cities

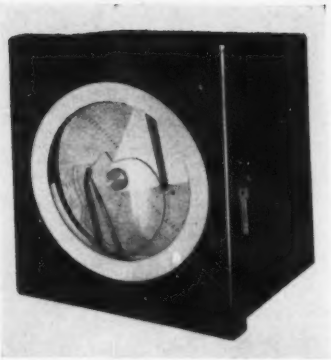


Fig. 1. Wheelco cam-operated program controller

Fig. 2. Wheelco round-chart recording controller

Cam-Operated Program and Round-Chart Recording Controllers

An entirely new Wheelco program controller is now available from Barber-Colman Co., Rockford, Ill. This controller, Fig. 1, has been designed for accurate, reliable, and automatic reproduction of any predetermined program. Temperature, speed, strain, flow, or any variable which can be resolved into a millivolt signal can be controlled in almost unlimited patterns by the electronic, round-chart cam-operated unit. Metalworking, ceramics, and glass are but a few of the wide variety of process applications.

A synchronous motor, equipped with a start-stop switch, drives the chart and cam. The cam can be driven independently if desired. Provision is made for either flush or surface mounting of the case.

The Double-O round-chart recording and indicating controller shown in Fig. 2 is one of another new line of Wheelco products. The high-quality features of the Barber-Colman, Wheelco electronic potentiometer line are said to have been incorporated into this full-sized recorder-controller line. These Double-O controllers are completely self-contained, null-balancing instruments requiring only an external sensing device. A wide range of models are available for the measurement, indication, control, and permanent recording of temperatures. With proper circuitry and the use of transducers, such variables as speed, strain, hydrogen ion (pH), and other quantities which can be resolved into electrical signals can be recorded and controlled.

This line gives 1/2 of 1 per cent accuracy for all scale spans in pyrometric range. All thermocouple and radiation pyrometer ranges down to 5 MV full scale are available.

Circle 616 on Readers' Service Card

(This section continued on page 222)

NEW! Logan 14" LATHES BEST DOLLAR VALUE IN THE LATHE FIELD

These new Logan 14" swing lathes are **DEPENDABLE.** Their capacity permits a broad range of machining operations. They have a 14⅛" swing over bed, a swing over saddle cross slide of 9", and a center distance of 28". Logan lathes are **ACCURATE.** The ball bearing spindle has a 1⅛" hole and a draw in collet capacity of 1 1/16". The variable speed drive (40 to 1400 RPM) adjusts while running —no need to stop and shift belts! Also, the two V-ways and flat ways are precision ground. Logan 14" lathes are **RUGGED.** The 10" wide and 56" long lathe beds are braced by oversize ribs to withstand torsional stresses. The Logan 14" lathe is your best dollar value. No other lathe in this price category offers you this same big work capacity with variable speed drive.

Model 6510
$1,775.00
F.O.B. Factory

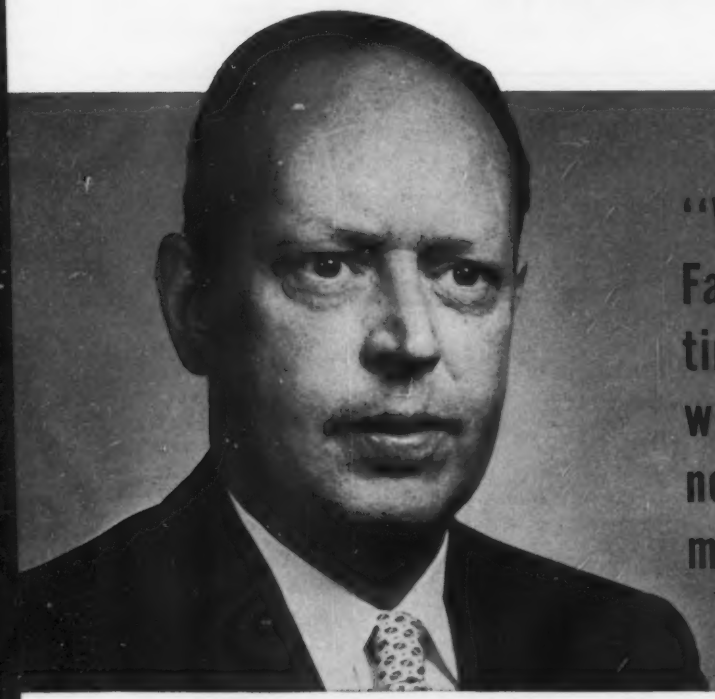
Write for complete specifications.

Logan
LOGAN ENGINEERING CO., DEPT. M-361
4901 W. Lawrence Ave., Chicago 30, Ill.

For more data circle this page number on card at back of book

OLIVER H. TRAGGE, President
Tragge Boring Company

a man who came to Fair Street



"We've been to Fair Street many times and every time we've learned something new about precision machining."

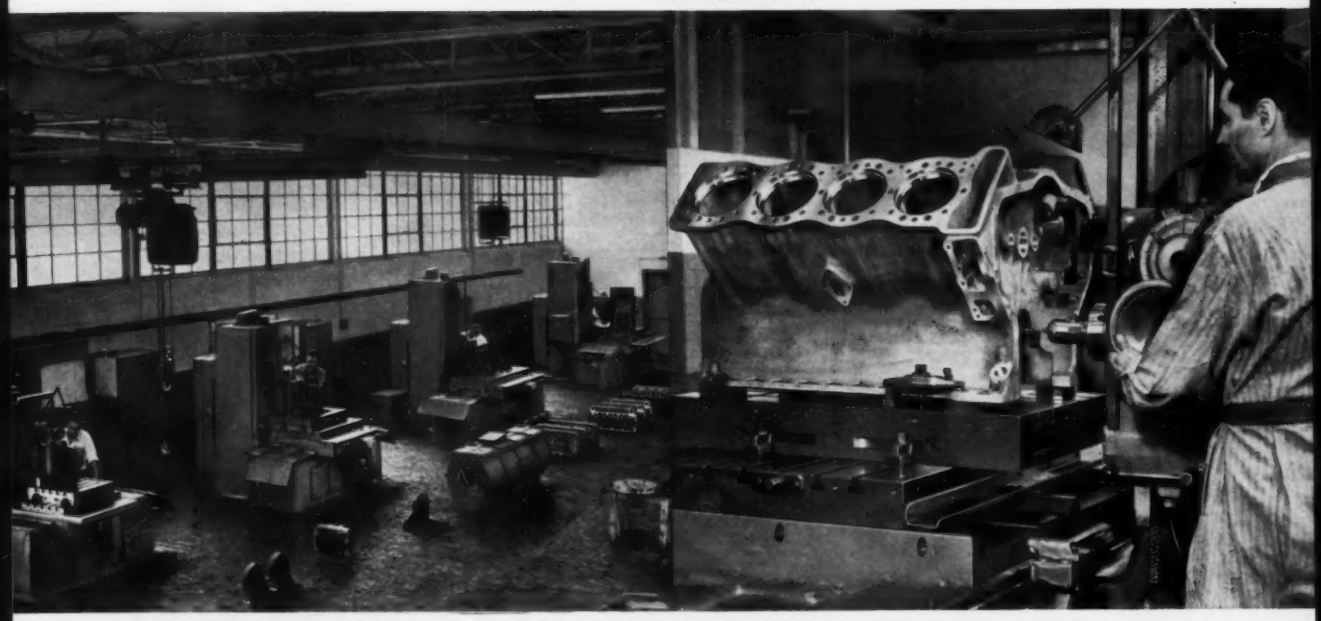
"During the course of buying four DeVlieg JIGMILS over a period of six years, we've been to Fair Street many times. Every visit has been an introduction to something new, not only in the development of the JIGMIL, itself, but also in the DeVlieg philosophy of precision machining and tooling. Of our four JIGMILS, the first was purchased as the direct result of a visit to Fair Street. From then on the JIGMILS sold themselves. Whenever business volume warranted, we added a new one. We honestly feel that the efficiency, accuracy and economy of the JIGMIL technique of jigless machining has been a big factor in the very favorable competitive position that our company has enjoyed in the past few years."

OLIVER H. TRAGGE

DE VLIEG MACHINE COMPANY, FAIR STREET • **ROYAL OAK, MICHIGAN**

SOME OF OUR JIGMIL USERS

AFC Industries, Inc.
Air Reduction Co., Inc.
Alliance Tool & Machine Co.
Amco Incorporated
Bendix Corp.
Besly Welles Corp.
Bethlehem Steel Co.
Burg Tool Mfg. Co.
Buhr Machine Tool Co.
Cessna Aircraft Co.
Cross Company
Farrel-Birmingham Co., Inc.
Gardner-Denver Co.
Gardner Machine Company
Goulds Pumps, Inc.
Harnischfeger Corp.
Hill Machinery Co.
Homogenette Inc.
Hoover Tool & Die Co.
Hyster Co.
Ideal Tool & Mfg. Co.
Lake Erie Machinery Corp.
Leesona Corp.
Marion Power Shovel Co.



STANDARD JIGMILS DO THE JOB

Shown above are the four standard DeVlieg JIGMILS installed at Tragge. Standard JIGMILS, such as these with Duplitrol automatic positioning and end measuring rods, are designed for "jigless boring," milling, drilling, tapping and reaming to precise limits of accuracy. Close-up view, above right, is of a standard model 3-B JIGMIL boring holes in a V-8 engine block at Tragge.

Mason, Shaver & Rhoades Inc.
Midwest Machine & Mfg. Co.
National Electrical Welding Machines Co.
National Mine Service Co.
New Deal Tool & Machine Co.
Paramount Boring & Machine Co.
Paul Machine Tool & Die Works
Quality Tool and Die Co.
R & B Tool Company
Rochester Products Div., GMC
Saginaw Steering Gear Div., GMC
Snyder Corp.
Standard Tool Co.
Vard Div., Royal Industries Inc.
Vogt, Henry Machine Co.

WILL YOU BE THE NEXT TO VISIT FAIR STREET

OUR NEWEST CATALOG WILL HELP YOU DECIDE. MAY WE SEND IT?

DeVlieg

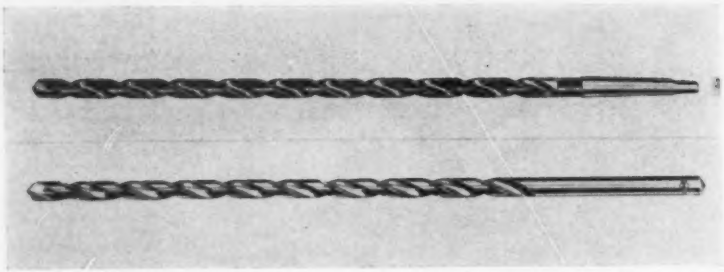
SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

For more data circle this page number on card at back of book

Extra-Length Drills

High-speed-steel extra-length drills designed for operations where inaccessibility is a problem or for extremely deep holes, announced by Whitman & Barnes, Plymouth, Mich. These drills are said to perform satisfactorily under the widest range of operating conditions and materials. According to the manufacturer, excellent service can be given on either straight- or taper-shank styles and in wire-gage or fractional sizes.



Diameters range from No. 52 wire gage to 1 1/2 inches, and over-all lengths, up to 23 1/2 inches. Larger diameters and longer lengths can also be furnished to special order.

Circle 617 on Readers' Service Card

PUSH BUTTON *Speed Selection*

from **to** **in seconds**

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* **PRECISION LATHES**

Write for

"Variable Speed" Circular and General Catalog showing . . .

•

10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)

•

13" and 15" SEBASTIAN Geared Head Lathes

•

SHELDON Milling Machines

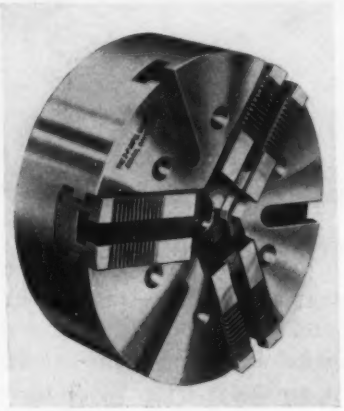
•

SHELDON Back Geared Shapers

SHELDON MACHINE CO., INC.
4246 N. Knox Ave. • Chicago 41, ILL.

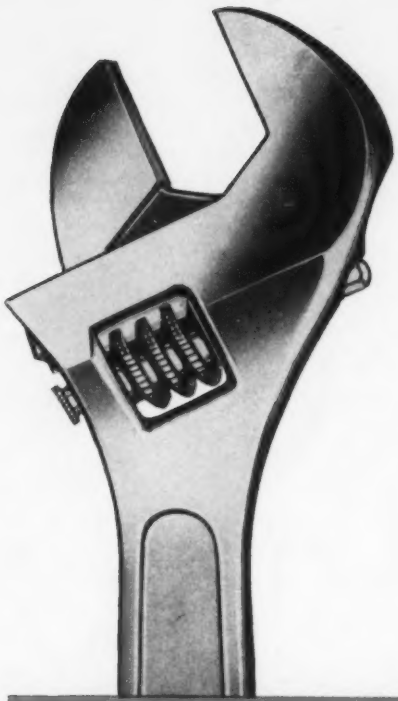
S-P Self-Centering Power Chuck

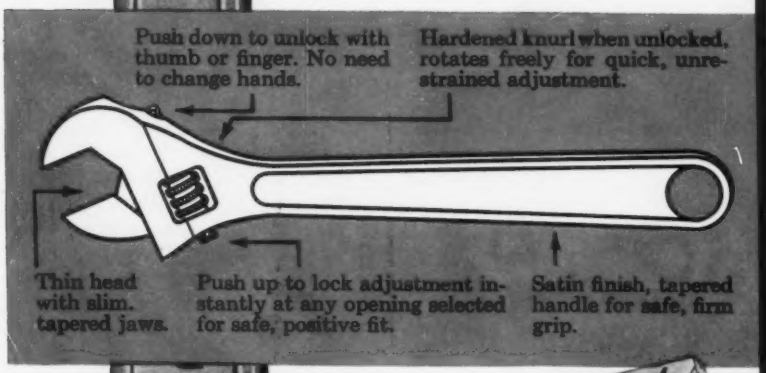
Greater gripping power for heavier, cost-cutting feeds and added safety are features claimed for this new 18-inch self-centering power chuck brought out by the S-P Mfg. Corporation, Cleveland, Ohio. Ruggedly built to American Standards, the body of the chuck is available either as a one-piece steel casting or a special aluminum-alloy forging, ground to a mirror finish and balanced for



high-speed production. Its greater gripping power, especially at high spindle speeds, results from a special cam-and-lever design. The greater leverage holds the work more rigidly while machining with heavy feeds and also provides added safety by resisting jaw opening due to centrifugal force at high speeds or fluctuations in air pressure. The chuck is available with two or three jaws and flame-hardened ways that maintain the close fit between master jaws and ways to insure longer life and to withstand the shock of

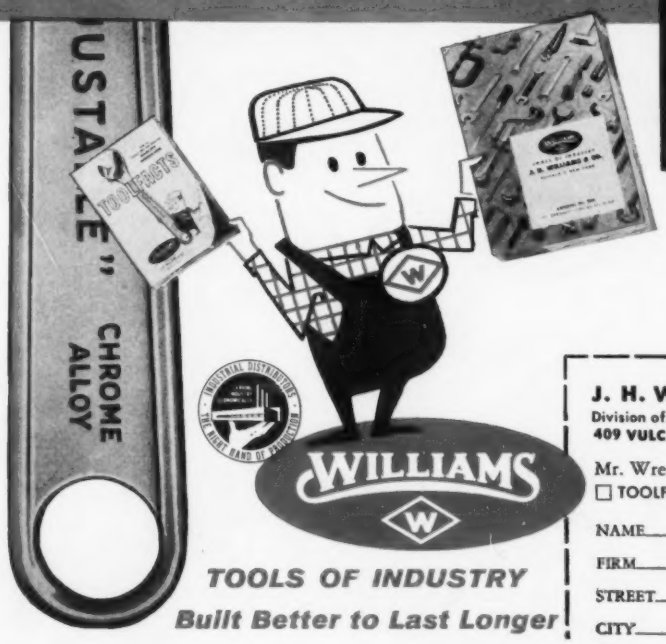
The **original** push button locking wrench by **Williams** ... **tough** enough to whip the meanest jobs, **accurate** enough for the finest adjustments




Push down to unlock with thumb or finger. No need to change hands.
Hardened knurl when unlocked, rotates freely for quick, unrestrained adjustment.
Thin head with slim, tapered jaws.
Push up to lock adjustment instantly at any opening selected for safe, positive fit.
Satin finish, tapered handle for safe, firm grip.

ONLY WILLIAMS HAS THIS EXCLUSIVE D-SLOT DESIGN

Williams' unique D-Slot design provides wide, square-shouldered tracks for full, positive bearing of the sliding jaw under any working stress. Slot is not subjected to spreading forces common to other adjustable wrenches. Performance is consistent ... parts replacement infrequent.



MR. WRENCH SAYS: Send for New Catalog listing 4530 stock tools and forgings. Also available... New TOOLFACTS booklet on how to select, use and care for Quality Wrenches.

J. H. WILLIAMS & CO.
Division of United-Greenfield Corporation
409 VULCAN STREET, BUFFALO 7, N.Y.

Mr. Wrench: Please send me your new
☐ TOOLFACTS Booklet ☐ ILLUSTRATED CATALOG No. 304

NAME_____ TITLE_____
FIRM_____
STREET_____
CITY_____ ZONE____ STATE_____

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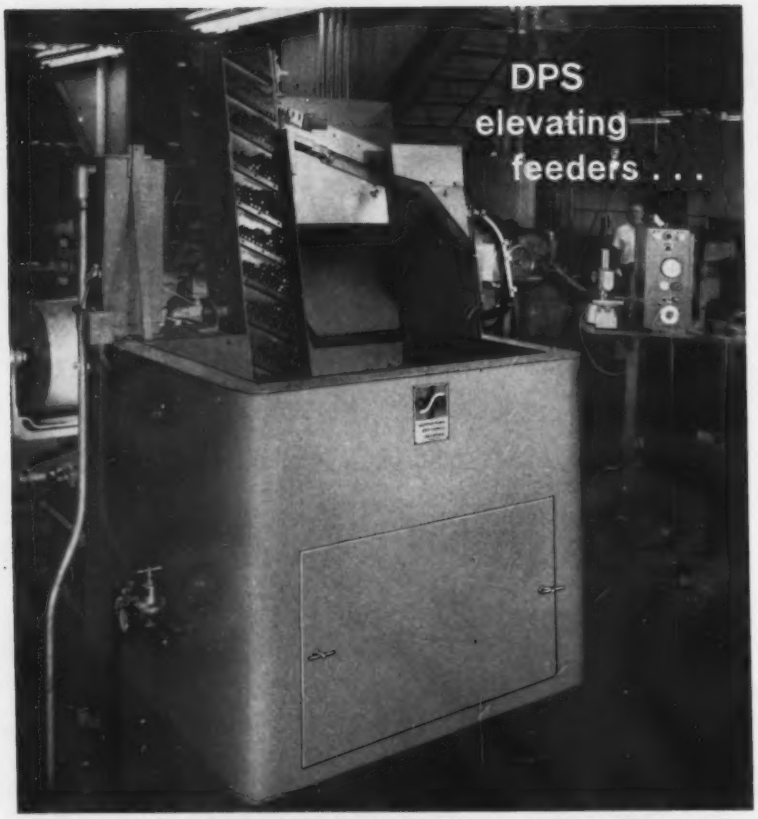


This 6-cu. ft. DPS elevating feeder handles 36 different sizes of rollers for spherical roller bearings. Rollers are elevated to feed track, where they are oriented, and sent along track to grinder in a continuous flow.

store and orient parts . . . feed at high speed

Today, many processing and assembly machines are not producing at rated capacity because of inadequate feeding arrangements. Hand feeding methods are often unable to match rated capacity of modern equipment . . . production suffers.

DPS elevating feeders are helping industry meet their feeding requirements. They orient and feed parts gently, and in a continuous flow to match production rates . . . handle parts of almost any material (metal, plastic, felt, rubber, etc.) and of practically any shape. Versatile in design, the elevating mechanism can be engineered to discharge parts to either side of feeder and at desired height. Feeders with 3, 6, 12 or 20 cubic foot storage hoppers are available.

Your DPS engineer is in a unique position to recommend the one best feeder from its line of rotary, vibratory and elevating types . . . the most complete in industry. Write or call today. Ask for elevating feeder folder 2812.

DETROIT POWER SCREWDRIVER CO.

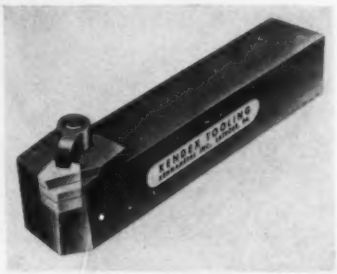
A Subsidiary of Link-Belt Company

Selective Parts Feeders; Screw, Nut and Stud Driving Machines; Special Purpose Assembly Machines

2799 W. Fort Street
Detroit 16, Michigan
TAshmoo 5-3070

increased speeds and heavier feeds. Maximum jaw travel is 1/2 inch. The chuck is also available with a draw-tube extension to provide clearance for tools such as boring-bars and reamers.

Circle 618 on Readers' Service Card



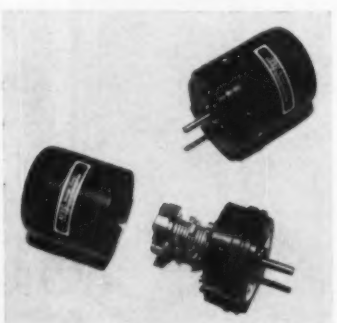
Kendex Throw-Away Inserts

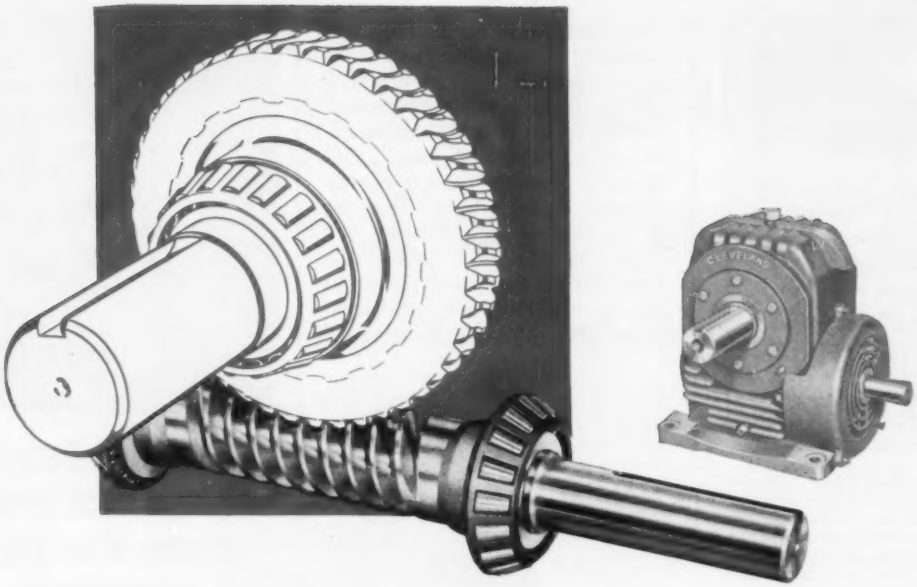
Five-sided Kendex inserts with ten cutting edges (Style PN) are used in this new Kendex Style KP tool offered by Kennametal Inc., Latrobe, Pa. These negative-rake throw-away inserts are regular pentagons with nose angles of 108 degrees, which add strength to the cutting points. The tools have a 30-degree lead angle. Two styles of tool-holders are available from stock: Style KPD for general turning and Style KPF for facing. There are five sizes of tool-holders for each style of tool and three sizes of inserts, defined by inscribed circles 3/8, 1/2, and 3/4 inch in diameter. Both precision and utility inserts are available.

Circle 619 on Readers' Service Card

Pic Adjustable Limit Stop

Improved precision limit-stop assembly that provides fully adjustable rotational limit control within an operational range of 30 to 4530 degrees has been announced by the Pic Design Corporation,





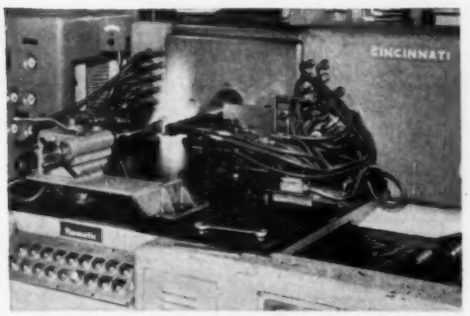
Flamatic-hardened worms help give Cleveland Speed Reducers their longer service life . . .

On all Cleveland Speed Reducers, alloy steel worms are cut integral with the shaft and accurately ground to a high surface finish on both thread flanks. Shaft extension diameter is especially large to permit increased overhung load capacity. Heat treatment is by a special "Flamatic" process—exclusive with Cleveland-made worms. This provides a high degree of hardness throughout the entire thread thickness and well below the worm's root diameter—(See etched worm cross-section).

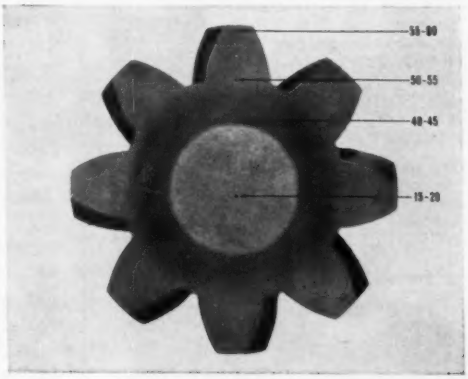
This new worm hardness pattern gives maximum thread strength and resistance to wear without sacrificing the advantage of a medium-hard tough core. Furthermore, the pattern is carried out in the worm shaft extension past the oil seal wearing surface to prevent the shaft being worn and damaged by its oil seal.

Mated with Cleveland's high density centrifugally cast bronze gears, the result is increased wear resistance—much longer trouble-free service life.

Why not write today for your free copy of Bulletin No. 405 showing the latest developments in the Cleveland Worm Gear Line. Or, better yet, contact your nearest Cleveland Representative and get the complete facts.



Worms are Flamatic-hardened in the Cleveland Plant (above) to give them the typical Rockwell "C" hardness pattern as shown in the etched cross-section (below).



CLEVELAND
Worm Gear
Speed Reducers

Cleveland Worm & Gear Division
Eaton Manufacturing Company
3276 East 80th Street • Cleveland 4, Ohio

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"THIS LUBRICANT ENABLED US TO INCREASE PRODUCTION"

says—PITTSBURGH TUBE COMPANY

"Our 70,000 pound Draw Bench was designed to operate at a maximum of 80 feet per minute, full load. We decided to increase the drawing speed on lighter tubing to 100 and 104 feet per minute. This overloaded the Speed Reducer, however, causing it to overheat. We tried four different makes of oils without success before trying LUBRIPLATE A.P.G. 90. With LUBRIPLATE, we are able to pull heavier tubing than before at 104 feet per minute without the Reducer overheating."

R. S. Vorous
Maintenance Engineer

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

For more data circle item 226A

East Rockaway, N. Y. This stop assembly is available from stock in a 3/16-inch shaft size and is offered in ball or oilless bronze bearing types. It is self-contained, in a black anodized case, 1 3/4 inches in diameter, and is readily adjusted by the setting of a series of washers, each governing 300 degrees of rotation. If desired, the stop will be furnished preset to any specified stop, without charge.

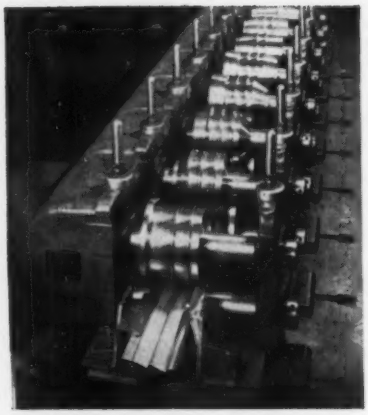
Circle 620 on Readers' Service Card

Milling Spindle and Slide Equipment of Building-Block Design

Superprecision milling spindle and slide assembly of building-block design available from Standard Electrical Tool Co., Cincinnati, Ohio. The spindle of this particular unit performs the major cutting operation on a special milling machine for milling the curvature on steel mill rolls, while the rolls remain mounted in their respective housings, without dismantling. The rolls are driven and the machining operation is accomplished in one rotation of the roll. Depths of cut vary from a light finish cut to a maximum of approximately 0.125 inch. The rolls are milled in pairs. The horizontal adjustment, parallel to the spindle center line, sets the cutter for various roll diameters. The milling cutter diameters are equivalent to the radii of the various roll grooves. This 20-hp motorized assembly has seven speed changes from a minimum of 70 rpm to a maximum of 450 rpm.

Circle 621 on Readers' Service Card

(This section continued on page 229)



Yoder Roll-Forming Equipment mass-produces shapes accurately, economically

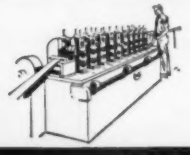
Yoder Roll-Forming Equipment, even with part-time operation, can effect significant savings in many metal working applications and industries. Shapes, simple or complex, can be quickly and economically produced the Yoder way from a wide variety of flat-rolled coated or uncoated stock . . . in thickness up to ¾ inch . . . in speeds up to 50,000 feet per day.

Yoder engineers flexibility and precision into metal forming operations. For example: many basic shape modifications, such as coiling, welding, notching, ring-forming, perforating, and cutting to length can be simultaneously accomplished with little or no additional labor cost.

Yoder also makes a complete line of Rotary Slitters and Pipe and Tube Mills. Profit from Yoder's years of engineering and service experience, contact your local Yoder representative or send for the Yoder Roll-Forming Manual.

This fully-illustrated 88-page book clearly discusses every important aspect of Yoder Roll-Forming Equipment and methods . . . it's yours for the asking!

THE YODER COMPANY
5504 Walworth Avenue • Cleveland 1, Ohio



ENGINEERING YODER MANUFACTURING
COLD ROLL FORMING MACHINES

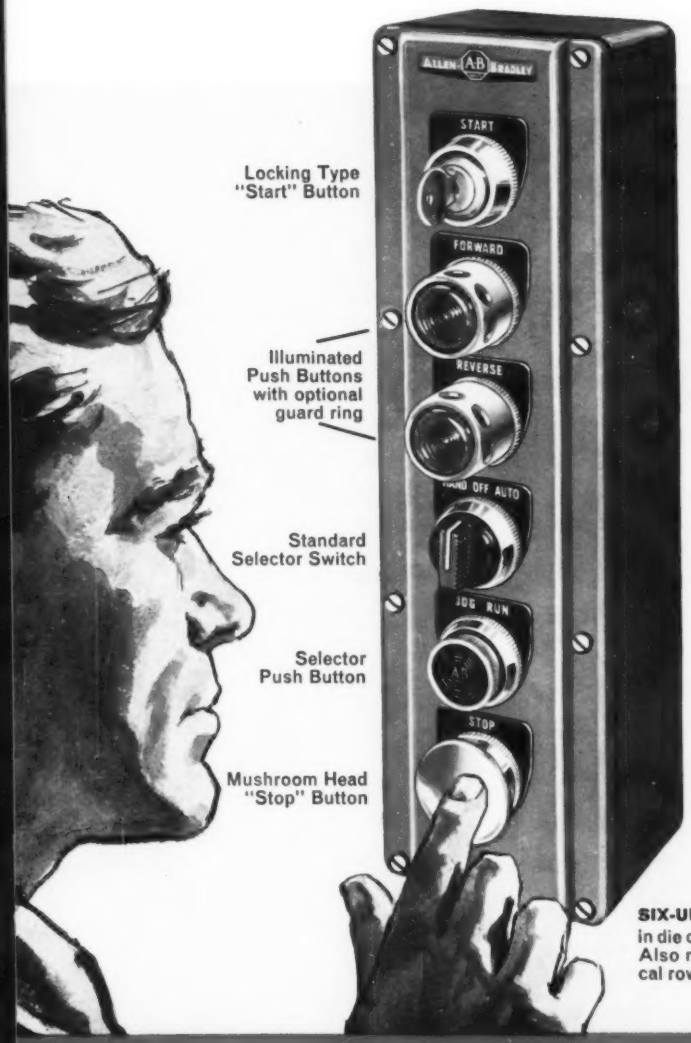
For more data circle item 226B

BE SURE YOU GET

Quality Appearance Quality Operation

Specify Allen-Bradley's line of **OILTIGHT CONTROL STATIONS**

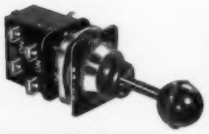
Allen-Bradley oiltight units and stations harmonize with the trim lines of modern machine tools —they look as if they were a part of the machine. Also, from the wide selection of control units, you'll be able to satisfy every operating requirement. A-B control units are positively oiltight—impossible for oils and cutting fluids to foul the contacts. And the silver contacts assure reliable operation. The rugged construction and generous wiring room of all A-B stations are valued by the installation engineer. Insist on Allen-Bradley pilot control units and stations—you can't make a mistake! Send for Publication 6090.



FLUSH HEAD
push button, also made with extended head.

WING LEVER PUSH BUTTON
Combines push button and selector switch.

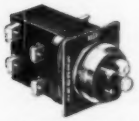
PUSH-TO-TEST PILOT LIGHT
Six different color lenses available.



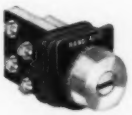
4-WAY SELECTOR SWITCH
Also furnished for 2-way operation.

PILOT LIGHT
Transformer or full voltage types.

DOUBLE CIRCUIT
Has 2 N.O. or 2 N.C. sets of contacts.



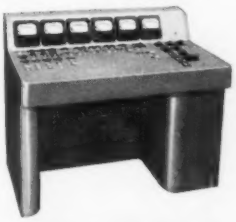
PILOT LIGHT CLUSTER
Four lights of different colors in one unit.



SELECTOR SWITCH
With coin slot operator. Other operators available.

CONVENIENCE RECEPTACLE
For plugging in work light or small tools.

SPECIAL CONTROL CONSOLES
can be furnished to meet your exact operating requirements.



SIX-UNIT CONTROL STATION
in die cast aluminum housing. Also made with up to 4 vertical rows with 4 units per row.

7-61-RM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

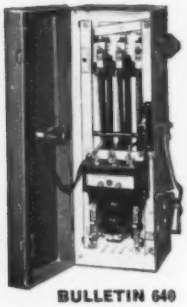
Where Reduced Voltage Motor Starting is Necessary...

Allen-Bradley has the best and most complete answer

No matter what your reason for reduced voltage motor starting may be, Allen-Bradley has the *right* starter. Not only can the power company's requirements be satisfied exactly, but the A-B starter will at the same time provide the best possible starting conditions for the motor and the driven load. At least one of the starters described below will completely satisfy your operating requirements. For more detailed information, send for Publication 6088.

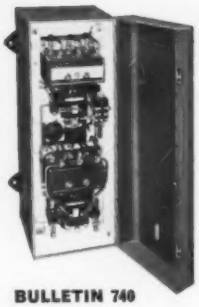
AUTOMATIC AUTOTRANSFORMER starter for squirrel cage motors that should not be started at full voltage. The autotransformer reduces line voltage during acceleration. Taps permit adjustment of voltage applied to the motor.

BULLETIN 746



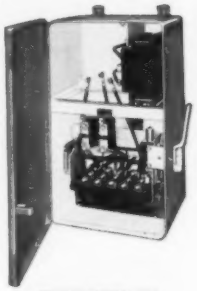
MANUAL STEPLESS RESISTANCE starter has graphite compression disc resistors for velvet smooth starting of squirrel cage motors. Starting of the motor is under the complete control of the operator.

BULLETIN 640



AUTOMATIC RESISTANCE starter has graphite resistors automatically inserted in series with the squirrel cage motor at starting. Resistors can easily be adjusted to motor and load conditions, giving velvet smooth acceleration.

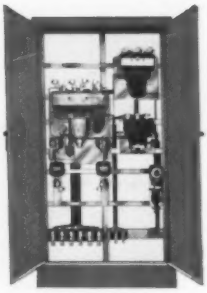
BULLETIN 740



MANUAL AUTOTRANSFORMER starter for use where load conditions or power company rules require reduced voltage starting. The air break starter shown has double break, silver alloy contacts.

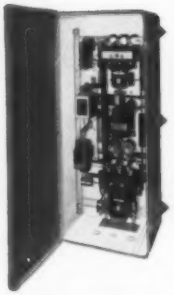
BULLETIN 646

AUTOMATIC MULTIPOINT RESISTANCE starter for use on network systems. Resistors inserted at starting are cut out in definite steps. Time intervals adjustable to provide velvet smooth starting.



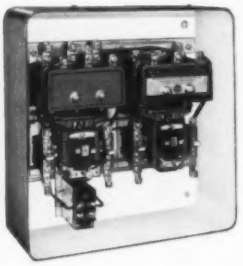
BULLETIN 741

AUTOMATIC STEPLESS RESISTANCE starter is not equalled for velvet smooth motor acceleration. It will satisfy any power company requirement. Eliminates lamp flicker on networks used for power and lighting.



BULLETIN 742

AUTOMATIC PART WINDING starter for use with squirrel cage motors having two separate parallel windings. Made in two-step type, and three-step type with resistance connected in the line on the first step.



BULLETIN 736

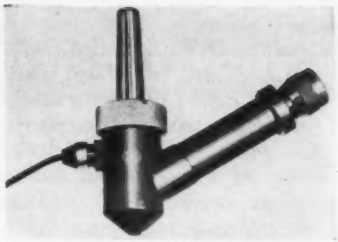
7-61 RM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL



Jig-Borer Microscope

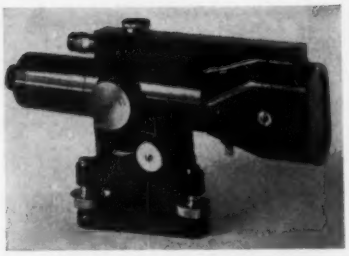
Jig-borer microscope announced by Opto-Metric Tools, Inc., New York City. This new model instrument has a low-voltage light source built directly into the tube, whereby it becomes completely self-contained. A beam splitter directs the light through the objective and thus provides vertical surface illumination, which is regulated through a variable transformer. Total magnification is 25× by 2× objective with 2 3/8-inch working distance and 12 1/2× adjustable eyepiece. The latter contains both a hairline cross and a series of concentric circles so that the instrument may be used for setting to reference points or for checking center distances between holes, respectively. Different shanks, taper or straight, are available. They are interchangeable and adjustable for truing.

Circle 622 on Readers' Service Card

Parker-Hannifin Hydraulic Relief Valve

Hydraulic relief valve of pilot-operated line brought out by the Parker-Hannifin Corporation, Cleveland, Ohio, as a companion line to its recently introduced machinery hydraulic check valves. The new relief valves have been designed to feature dependable performance, rugged construction, and long service life. They are engineered for a minimum 5-to-1 safety factor over the rated operating pressure. The line-mounted type valves are intended for 3000-psi hydraulic systems, while the gasket-mounted units are rated at 5000 psi. Both series are provided in rated capacities of 20 and 50 gpm (gallons per minute). Subplates are offered for use with the gasket-mounted type. The valve bodies were designed for SAE hydraulic straight threads as well as pipe threads.

Circle 623 on Reader's Service Card



Self-Setting Optical Level

Autoset optical level developed by Hilger & Watts and introduced in this country by Engis Equipment

HAMILTON Tapping MACHINE

SUPER SENSITIVE

2992

Capacity — 000-120 to 10-24

In the field of small hole, precision tapping the HAMILTON Super Sensitive Tapping MACHINE stands alone. It is smooth, silent, precise, and sturdy. Spindle returns to neutral position and stops rotation instantly and automatically when pressure on the feed lever is released. To learn what this means to you,

write for our free Bulletin No. 2992.

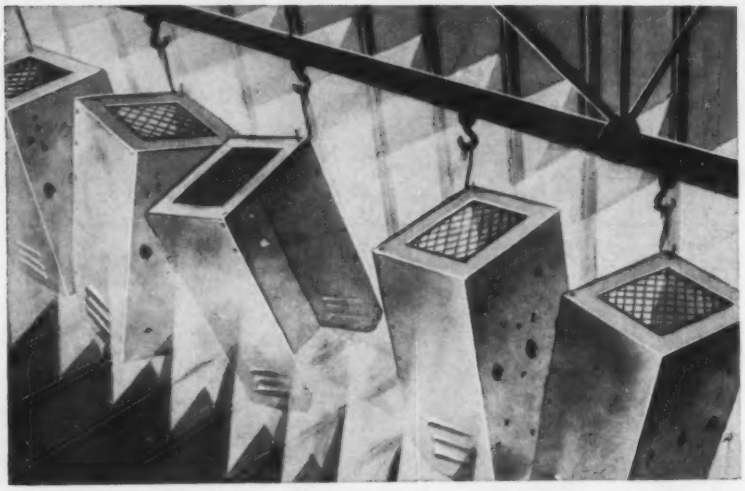
THE HAMILTON TOOL COMPANY

834 SOUTH NINTH STREET HAMILTON, OHIO

For tough steel cleaning jobs

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



New acid cleaner Oakite 86 gives fast smut removal . . . good paint grip

Shop smuts on steel parts disappear fast with Oakite 86 in the washing machine. A superior acid detergent, it removes all kinds of soils efficiently—really goes to work on heavily smutted steel. In addition, it forms a conversion coating on steel surfaces to give a good grip on subsequent paint coats . . . helps inhibit corrosion.

Oakite 86 also works well when aluminum, zinc, brass and terneplate pass through the washer.

And it is just the latest in a complete line of Oakite materials for spray washing machines. Others include products for high-pressure spraying, for rapid cleaning, for heavy-duty cleaning, for low-heat cleaning, for conversion coatings. Ask the Oakite man which one will work best with your machines, your metals, your specific jobs. Or, write for FREE bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 years' leadership in industrial cleaning

SCIENCE

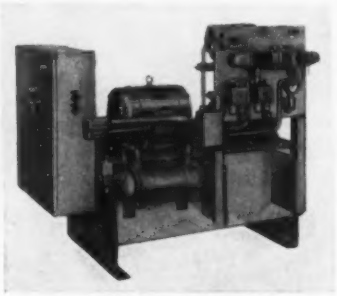
Co., Division of Engineering & Scientific Instrumentation, Chicago, Ill. This instrument automatically maintains a level line of sight even when its telescope is tilted. The self-leveling device consists of a fixed prism (which gives an erect image) rotating above two swinging prisms. When the telescope is tilted, the suspended prisms change their relation to the axis of the telescope and so maintain a level line of sight. Frictionless suspension assures a repetitive setting action closer than 1 second of arc; oscillation of the prisms is eliminated by an air-damped piston, which also limits the swing to plus or minus 20 minutes. The instrument reads directly to 0.001 inch over 1/2 inch and has a focusing range of 6 feet to infinity. Machine tool beds and foundation pads for heavy equipment can be quickly leveled by using a special target on an end bar.

Circle 624 on Readers' Service Card

Hannifin Power Unit

One of a new line of Hannifin "Hy-Power" continuous-booster hydraulic power units featuring automatic "Hi-Lo" oil intensification to 5000 psi has been announced by the Hannifin Co., Des Plaines, Ill., a division of Parker-Hannifin Corporation. The Hannifin "CB" power unit is offered in standard 30- and 60-gallon reservoirs with constant or variable pump volumes to 32 gpm. Primary oil pressure is provided up to 1000 psi, then automatically intensified to 3000 or 5000 psi, depending on the booster ratio selected. These power units are especially suited for applications requiring unusually long power strokes, high holding pressures, or multiple cylinder arrangements.

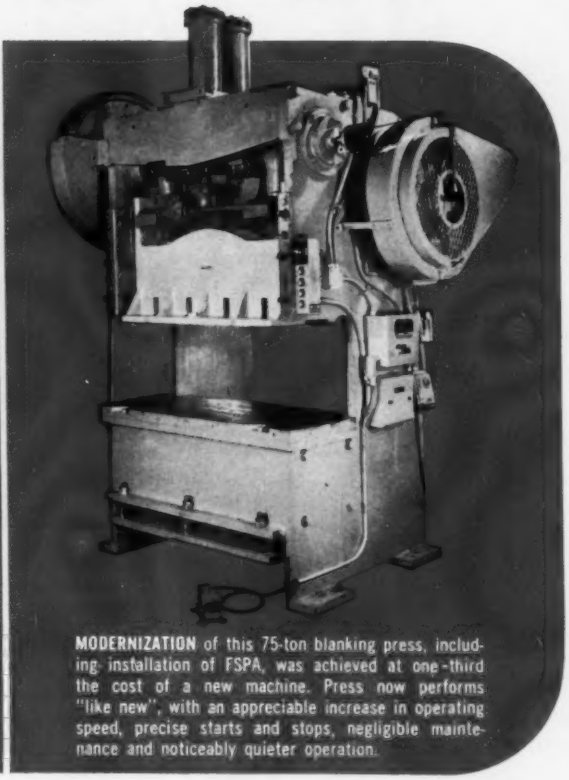
Circle 625 on Readers' Service Card



DESIGN or MODERNIZE POWER PRESSES

...with Fawick FSPA

ADVANCED DESIGN of this new press incorporates Fawick Standardized Press Application to insure high-efficiency clutch and brake service needed for machine's 300-stroke-per-minute operating speed. Built by Precision Welder and Flexopress Corp., Cincinnati, the 100-ton press stamps hermetic motor parts 2½ times faster than was previously possible.



MODERNIZATION of this 75-ton blanking press, including installation of FSPA, was achieved at one-third the cost of a new machine. Press now performs "like new", with an appreciable increase in operating speed, precise starts and stops, negligible maintenance and noticeably quieter operation.

... for *high-speed production with precise control*

The FAWICK Standardized Press Application provides the superior air clutch and brake performance needed to gain faster, more precise operation of power presses and other cyclic machines.

For original equipment or for modernization, FSPA helps you fight rising costs. It provides simple, economical installation with wide flexibility of application. Instant air clutch action insures fast, accurate cycling, with unmatched low maintenance and positive safety. Tools and dies are protected through elimination of backlash.

The FSPA package incorporates the dependable FAWICK CB Airflex Clutch, self-energizing CS Brake, Timing Rotorseal and high-speed clutch controls. Standard units are produced for crankshaft mounting on presses in the 5 to 150-ton range. Other conversion units are available for presses up to 2000 tons capacity.

For engineering information call your nearest FAWICK representative or the Home Office.

you can apply FSPA on new or used:

- geared presses
- non-geared presses
- press brakes
- press feeders
- shears
- cut-off machines
- benders
- formers
- forging machines
- seamers
- upsetters

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON ROAD • CLEVELAND 11, OHIO
Fawick Canada, Ltd., 60 Front St., West, Toronto, Ont., Canada

FAWICK AIRFLEX

INDUSTRIAL CLUTCHES AND BRAKES

For more data circle this page number on card at back of book

NEWS of the Industry

Isabel Shamlian

California

ROBERT H. CLARK has been named sales engineer in the Los Angeles, Calif., metropolitan area for AMERICAN DRILL BUSHING CO., Los Angeles. Mr. Clark was formerly on the vice-president's staff.

MICHAEL J. FINK has been named vice-president and general manager of MECHANICAL SPECIALTIES CO., Los Angeles, Calif. Mr. Fink joined Mechanical Specialties as chief engineer in 1959 and was elected vice-president of engineering in 1960.

Michael J. Fink, newly appointed vice-president and general manager, Mechanical Specialties Co.

Illinois, Indiana, and Ohio

PRODUCTO MACHINE CO., Bridgeport, Conn., has announced that new manufacturing facilities for special die sets are now in operation at 4639 Washington Blvd., Chicago 44, Ill. The new plant, operated in conjunction with Producto's Chicago distributor, FEDERAL-BYRANT MACHINERY CO., will provide service to the north-central, southwest-central, and Rocky Mountain areas.

ALBERT S. BURGOYNE has been appointed vice-president and general manager of CHICAGO-LATROBE, a division of UNITED GREENFIELD CORPORATION, Chicago, Ill.

Albert S. Burgoyne, newly appointed vice-president and general manager of Chicago-Latrobe

HAROLD BYRON SMITH, JR., has been named manager of new product divisions by ILLINOIS TOOL WORKS, Chicago, Ill. In his new capacity, Mr. Smith will be fully responsible for the operation of the PAKTRON DIVISION, Alexandria, Va., and the CONEX and FASTEX DIVISIONS, Des Plaines, Ill.

ROBERT C. JACOBS has been named general manager of the automotive gear division of EATON MFG. CO., Richmond, Ind. Mr. Jacobs, who joined the company in 1946, was formerly assistant general manager of the division.

PARKER-HANNIFIN CORPORATION, Cleveland, Ohio, has elected ROBERT W. CORNELL executive vice-president. He will have general responsibility for all industrial and mobile equipment business, including the PARKER FITTINGS & HOSE DIVISION and PARKER HYDRAULICS DIVISION, Cleveland; and the HANNIFIN CO. division, Des Plaines, Ill. EARL C. DAVIS has been advanced to field sales manager, heading the staff of representatives for mobile equipment components. Succeeding Mr. Davis as Parker Hydraulics Division sales manager is WILLIAM E. BALLANTYNE. HAROLD E. LEWIS has been assigned to the Parker-Hannifin sales office, 10737 W. McNichols Road, Detroit 21, Mich., to become district manager of mobile hydraulic sales, with accounts in Michigan and Canada. RICHARD JOHNSON has been appointed sales engineer on mobile hydraulic components for Kansas, Nebraska, Iowa, Missouri, Oklahoma, and Texas. MEL REDMAN has been made sales engineer on mobile hydraulic components, with assigned accounts in the Chicago, Ill., area.

Robert W. Cornell, new executive vice-president of Parker-Hannifin Corporation

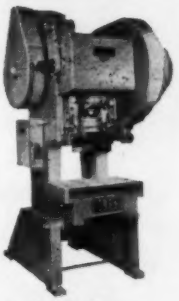
Louisiana

The appointment of H. R. DAVIES SALES & ENGINEERING, New Orleans, La., as its sales agent in southeast Louisiana and southwest Mississippi has been announced by JOSEPH T. RYERSON & SON, INC., Houston, Tex.

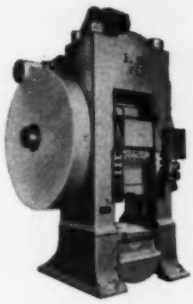
Michigan, Minnesota, and Wisconsin

JOHN K. RYE has been elected president of F. Jos. LAMB CO., De-

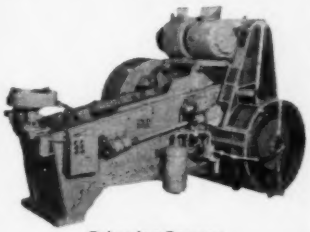
Why do more people buy BLISS presses than any other make?



Inclinable Presses
single crank and double crank

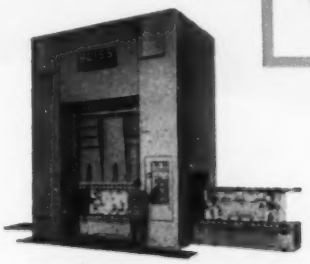


Knuckle Joint Presses

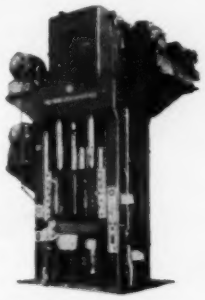


Extrusion Presses

Eccentric Presses

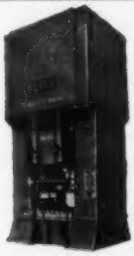


Rolling Bolster Presses



Hydro-Dynamic Presses

High Production Presses



Toggle Drawing Presses

(they do, and have for a long, long time)

No matter what kind of press suits a particular job best, Bliss can supply it.

And Bliss engineers' many years of expèrience is a valuable plus when it comes to recommending the right press. Straightside, inclinable, high-production, toggle, overdrive, underdrive, hydraulic—Bliss builds them all; grinds no axe for any one type.

But above these advantages . . . above Bliss engineering counsel and the vast Bliss parts and service organization that blankets the country . . . is the century-old Bliss tradition of quality and reliability.

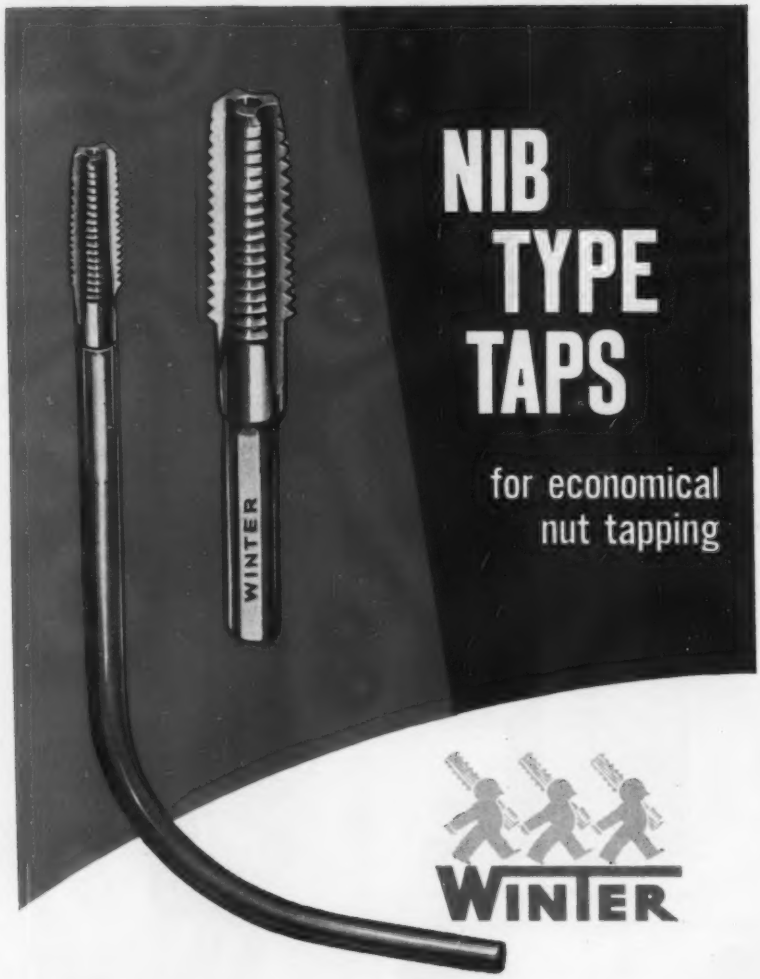
"Bliss is more than a name . . . it's a guarantee" is more than a combination of nice-sounding words. It's a simple statement of fact.

BLISS
SINCE 1857

E. W. BLISS COMPANY · **Hastings, Michigan**

BLISS is more than a name—it's a guarantee

PRESSES • **ROLLING MILLS** • **ROLLS** • **DIE SETS** • **CONTAINER MACHINERY** • **CONTRACT MFG.** • **PUBLIC SAFETY**



Winter Brothers' Nib Taps with *Balanced Action* offer greater production economy on automatic nut tapping operations than conventional one-piece tapper taps. When the tap becomes worn, only the nib section itself requires replacement. Nibs are easily assembled to the shank by brazing or sweating, butt welding, or by means of spline-drive or threaded connections.

Investigate the cost-cutting possibilities of Winter Brothers' Nib Taps. They're available in a complete range of thread sizes in either bent- or straight-shank design for tapping a wide variety of materials.

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
CHICAGO • DALLAS • SAN FRANCISCO • LOS ANGELES

Choose from
Winter's Wide Line of
Taps, Dies and Gages

CALL YOUR WINTER DISTRIBUTOR

troit, Mich. Mr. Rye joined the company in 1951 as assistant general

John K. Rye, newly elected president of F. Jos. Lamb Co.

manager. He was successively made general manager and vice-president-general manager.

NATIONAL TWIST DRILL & TOOL Co., Rochester, Mich., has announced the election of WILLIAM E. ATCHLEY as vice-president in charge of sales. Mr. Atchley, who joined the company in 1943, was formerly sales manager for the firm. FRED D. LAMB,

William E. Atchley, vice-president in charge of sales for the National Twist Drill & Tool Co.

JR., has been appointed general sales manager and HOWARD M. EASTON is now assistant general sales manager for the company. Mr. Lamb has held various field sales positions and managerial posts. Mr. Easton has been in field sales in Cleveland, Ohio; Hartford, Conn.; and Philadelphia, Pa. REX F. SUPERNAW has been ap-

Fred D. Lamb, Jr., new general sales manager of National Twist Drill & Tool Co.

Howard M. Easton, assistant general sales manager, National Twist Drill & Tool Co.

pointed chief metallurgist. Mr. Supernaw joined National Twist Drill & Tool Co. in 1935.

RICHARD E. QUAYLE has become manager of the Detroit, Mich., office of LELAND-GIFFORD CO., Worcester, Mass. Associated with Leland-Gifford for twenty-five years, Mr. Quayle had previously been a sales engineer in Detroit and, more recently, was manager of the Indianapolis, Ind., office.

Integration of TUBULAR MICROMETER CO., St. James, Minn., with GEORGE SCHERR CO., INC., New York City, making Scherr an integral part of the St. James firm, has been completed through acquisition by the St. James company of all outstanding Scherr stock in exchange for 100,000 shares of Tumico common stock. The corporate name has been changed to

SELF-THINNED HEAVY DUTY DRILLS*

eliminate web thinning operations

NATIONAL TWIST DRILL & TOOL

National

Self-thinned Heavy Duty Drills, now available with straight shanks, as well as with taper shanks, give improved drilling performance and longer life on all tough, hard metals. A patented, pre-thinned web design eliminates manual web thinning operations when resharpening . . . throughout the useable life of the drill! Absolute centrality of the web-thinned portion is thus guaranteed; surface-treated cutting faces remain intact.

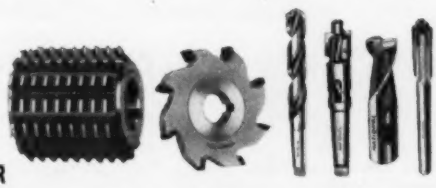
Self-thinned Heavy Duty Drills by National are real 'cost-cutters' on hard-to-machine materials such as stainless and alloy steels, armor plate, hard cast iron and high temperature alloys. Call your local National Distributor for these tools with the famous *plus*.

NATIONAL TWIST DRILL & TOOL COMPANY

Rochester, Michigan, U.S.A.

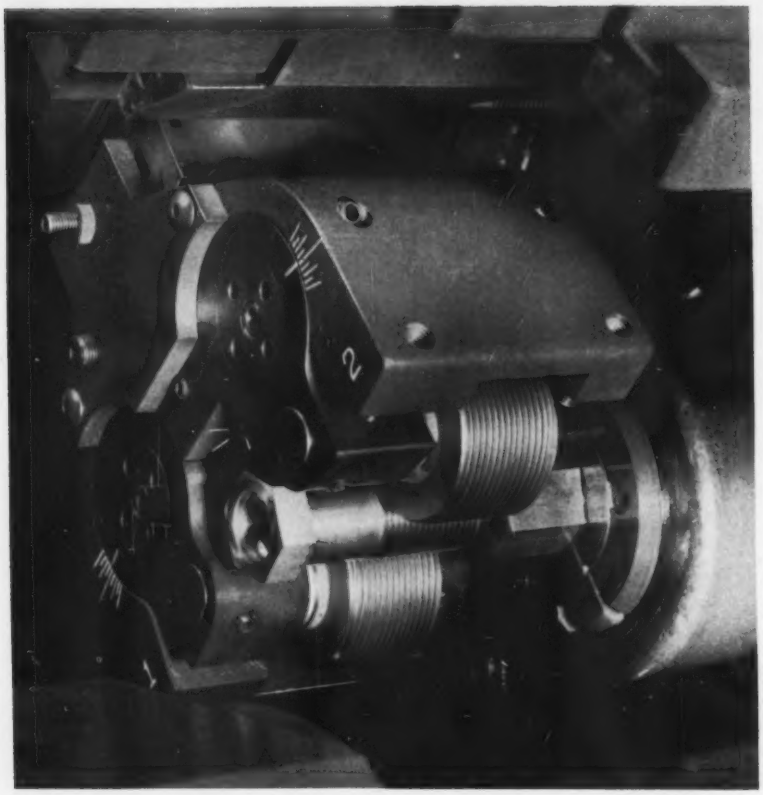
DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK CHICAGO • DALLAS • SAN FRANCISCO • LOS ANGELES

*Just One of National's Parade of Plus Products

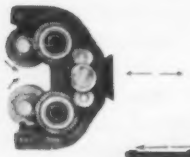


CALL YOUR NATIONAL DISTRIBUTOR

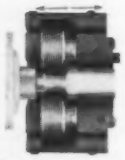
For more data circle this page number on card at back of book



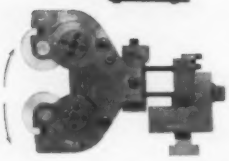
Reed Thread Rolling Attachments feature Self Compensating Roll Action



ADVANCE COMPENSATOR
- Eliminates Strain in Gear Train
- Permits Interchanging Rolls of Same Diameter
- Allows Either Roll to Contact Work Blank First



SIDE FLOATING COMPENSATOR
With New Anti-friction Bearing Unit
- Reduces Side Thrust on Rolls
- Permits Use of Standard Diameter Rolls under varying operating conditions



ALIGNMENT COMPENSATOR
- Provides parallel alignment of rolls during rolling
- Assures smooth contacting and withdrawal of rolls

Write for your copy of Thread Rolling Attachment Bulletin B-2 for helpful information on Thread and Form Rolling

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

TRA-171

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

SCHERR-TUMICO, INC.; headquarters are at St. James. Three wholly owned subsidiaries which operate as complete regional distribution centers with warehouses, showrooms, and branch sales offices are now named SCHERR-TUMICO NEW YORK CO., SCHERR-TUMICO CHICAGO CO., and SCHERR-TUMICO LOS ANGELES CO.

OILGEAR CO., Milwaukee, Wis., has appointed ERNEST WIEDMANN director of engineering. Mr. Wiedmann was formerly chief engineer, the position to which RANSOM TYLER has been appointed. FRED NEUMANN and RUSSELL LABORDE were promoted to engineering supervisors. WILLIAM DOUGLAS replaces Mr. Neumann as engineering laboratory supervisor. NORBERT NITKA has been appointed chief systems engineer and WILFRED BUBLITZ, chief electrical engineer.

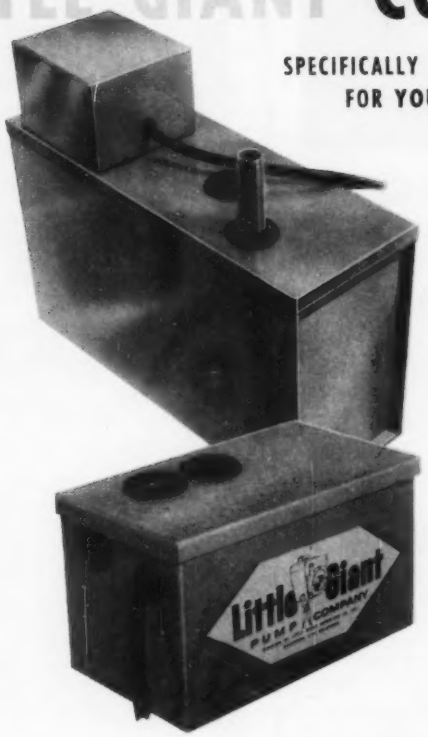
New England

LELAND-GIFFORD CO., Worcester, Mass., has announced the appointment of two new field representatives. JOHN RATERMANN has been named manager of sales in the Indiana-Ohio-Kentucky area, with headquarters in Cincinnati; and EDWIN DERINGER has joined the Chicago, Ill., sales force, with offices located at 2515 W. Peterson Ave. in Chicago.

NORTON CO., Worcester, Mass., has announced the following appointments: RALPH F. GOW was elected president of the company. JOHN JEPPSON becomes executive vice-president, succeeding Mr. Gow. ROBERT CUSHMAN has been made vice-president and general manager of the abrasive division. Mr. Gow has been executive vice-president

Ralph F. Gow, newly elected president of Norton Co.

LITTLE GIANT CONDENSATE UNITS



SPECIFICALLY DESIGNED FOR YOUR NEEDS

Little Giant condensate units are especially designed to fit any mechanical refrigeration or air conditioning unit for condensation removal. Available with positive displacement double pole switch, depending on model. Sturdy metal tanks resist corrosion. Available for 115V, 60 cycle or 230V single phase.

For complete specifications, contact:

Little Giant PUMP COMPANY

DIVISION OF LITTLE GIANT CORPORATION
3810 N. Tulsa • Oklahoma City, Okla.

For more data circle item 237A

VADEN VANISOUL

New Epoch making Additive in the preparation of Water-Soluble Grinding Fluid.

By adding 1% in volume of VADEN VANISOUL to water, a splendid grinding fluid, excellent both in anti-rust and machining capacities, will be produced.

This fluid guarantees the most precise and cleanest finish to the metal work surfaces, while improving the grinding efficiency.

(For further Technical Literature please apply to us)

SATO SPECIAL OIL CO., LTD.
30, 3-CHOME, IMAFUKU-NAKA, JOTO-KU,
OSAKA, JAPAN
TEL. OSAKA (33) 2974 · 4090

For more data circle item 237B

ALLENAIR CORP., 255 East 2nd St., Mineola, N. Y. MA-3

Name.....

Company.....

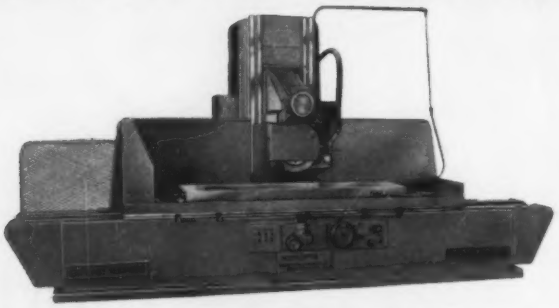
Address.....

City.....Zone.....State.....

For more data circle item 237C

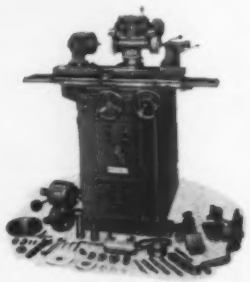
FOR

MAXIMUM PRECISION IN TOOLROOM OR PRODUCTION GRINDING



MODEL F HYDRAULIC FEED SURFACE GRINDER a production type with cross sliding head, built in sizes ranging from 12" x 18" x 48" to 30" x 25" x 120". Heavy, powerful grinder with maximum table speed of 150' per minute. Motor mounted directly on grinding wheel spindle to assure full power is transmitted directly to wheel. Automatic feeds in increments from .0001" to .001" per reversal available.

NO. 10 UNIVERSAL CUTTER AND TOOL GRINDER built to meet the need for a high grade machine of medium capacity at a moderate price. Combines rigidity with maximum convenience of operation. Head swivels 360°, locks in any setting; table swivels 90°. Hand operated longitudinal movement. Two spindle speeds.



NO. 20 HAND FEED SURFACE GRINDER has hand wheels for vertical and longitudinal table movement to assure toolroom precision and exceptionally fine finish. One-piece column and base, greased-for-life ball bearing spindle. Available with portable, motor driven coolant system.

GRAND RAPIDS

John Jeppson, executive vice-president, Norton Co.

since 1948. Mr. Jeppson joined the firm in 1940.

RICHARD E. SHAW has been made head of the COGSDILL DRILL ENGINEERING DEPARTMENT by THREADWELL TAP & DIE CO., Greenfield, Mass. Mr. Shaw has had extensive training on machine operations and other subjects relating to the manufacture of metal-cutting tools.

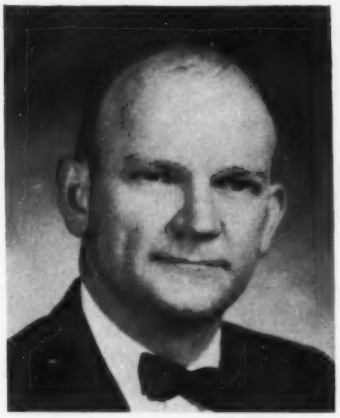
FAFNIR BEARING CO., New Britain, Conn., has announced the election of HORACE B. VAN DORN as vice-president in charge of engineering, with HOWELL L. POTTER assuming Mr. Van Dorn's former post as director of engineering. RONALD P. REMORENKO has been named assistant chief research engineer. In addition, R. M. CRUM has been announced as manager of the Ohio region, comprising the Cleveland and Cincinnati territories; W. H. SCHAUER becomes district manager in the Cincinnati territory; and E. C. GAURON has been named manager of the Pittsburgh, Pa., region. Mr. Gauron will be responsible for sales in the Rochester as well as Pittsburgh territories and for warehouse operations in Pittsburgh.

Appointment of EDMUND WEST as works manager has been announced by ALLEN MFG. CO., Hartford, Conn.

Mr. West will be in charge of all phases of production and production control, manufacturing engineering, and industrial engineering.

GEORGE M. LAMB has been named sales manager for MOORE SPECIAL TOOL CO., Bridgeport, Conn. Mr. Lamb, who has been with Moore since 1940, was sales engineer in the New England territory for the last fourteen years.

F. STEELE BLACKALL III has been elected president of TAFT-PEIRCE



F. Steele Blackall III, president of Taft-Peirce Mfg. Co.

MFG. CO., Woonsocket, R. I., succeeding his father, FREDERICK S. BLACKALL, JR. The new president has been with the firm since 1949.

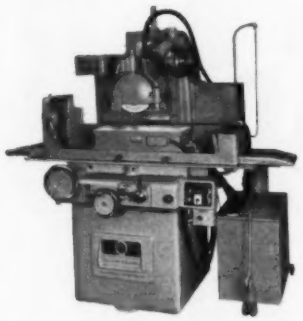
New York and New Jersey

AIR REDUCTION SALES CO., a division of AIR REDUCTION CO., INC., New York City, has appointed H. D. MANN assistant manager—engineering services for the company's district office in Cleveland, Ohio. He succeeds L. W. KUNKLER, who has been named manager of Airco's district office in Buffalo, N. Y. N. F. MOODY has been named sales manager of the eastern region, which includes district offices in New Jersey, Massachusetts, New York, Penn-

YOU

CAN FIND THE RIGHT MACHINE FOR YOUR NEEDS ON THESE PAGES

NO. 60 UNIVERSAL CUTTER AND TOOL GRINDER offers precision sharpening, fast set-ups and low maintenance. Designed for maximum convenience of operation, with work weight carried directly over base, permitting operator to stand close to work. Master hand wheel provides three speeds of longitudinal table travel.



NO. 360 HYDRAULIC FEED SURFACE GRINDER. A precision toolroom type which offers absolute accuracy with micro-inch finish at production speeds. One-piece column and base, infinite longitudinal table speeds from 3" to 120' per minute, variable speed cross feed. Available with new incrematic downfeed with automatic spark-out after pre-set stock removal.

NO. 1230 HYDRAULIC FEED O.D. & I.D. GRINDER meets the needs of users requiring a machine that does both internal and cylindrical grinding. It is a rugged, precision tool capable of taking rough cuts as well as producing the finest finish. Has a host of controls and adjustments for maximum convenience and versatility of operation.

A note on your letterhead will bring full details. Please specify the type of grinder you are most interested in.

GALLMEYER & LIVINGSTON CO., 305 Straight Ave., S.W., Grand Rapids, Mich.

GRINDERS

GALLMEYER & LIVINGSTON

when drilled with *

ELDORADO GUN DRILLS:

Eldorado Gun Drills are your best guarantee for excellent surface finish and top quality performance in gun drilling flawless, straight, round, accurately located holes at high speeds in one single operation. Each Eldorado Gun Drill is precision made to exacting specifications by gun drill specialists. Gun drill making is our business, our only business.

With hole after hole, in drilling steel, iron, aluminum or other alloys, at speeds and feeds impossible with other types of drills, Eldorado drills cut costs in time, labor, tools, materials and maintenance.

There's an Eldorado Gun Drill for your job! Immediate delivery from factory stock. We invite you to talk over your 'hole' problem with us at no obligation.

Send for NEW LITERATURE on Gun Drills and Gun Reamers.

ORDER STOCK SIZES FOR IMMEDIATE SHIPMENT. TO SPECIFICATIONS, ON NORMAL DELIVERY.

MADE TO YOUR SPECIFICATIONS:		AVAILABLE FROM STOCK:	
Sizes	.1250" to 2" dia.	⅛" to ½" dia. in 64ths	½" to ¾" dia. in 32nds
OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit you need	.750" dia. x 2¾" long	1" dia. x 2¾" long
Tips	Carbide	Carbide	Carbide

Now, order from stock, or send in your specifications for a prompt quotation.

Specializing 100% in Gun Drills and Related Tools.

ELDORADO TOOL & mfg. corp.

* Trade Mark

348 BOSTON POST ROAD • MILFORD, CONN.

sylvania, and Ohio. He succeeds A. S. BLODGET, who is now vice-president, midwestern region.

DENISON ENGINEERING DIVISION, AMERICAN BRAKE SHOE CO., Columbus, Ohio, has established a new sales office at 790 Linden Ave., Rochester, N. Y. THOMAS TAUER directs sales of Multipresses, while PHILLIP SHRIDER is in charge of pump and controls sales in the area.

Appointment of JAMES D. LOREE as manager of distributor sales for the district of New York state outside of metropolitan New York City has been announced by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio.

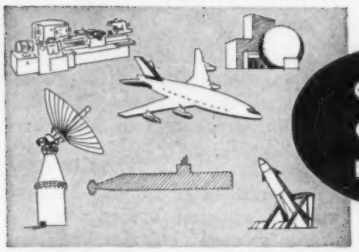
WALTER KIDDE & CO., INC., Belleville, N. J., announced the sale of the business formerly conducted by the KIDDE PRECISION TOOL CORPORATION, Roseland, N. J., to a newly formed company, the KPT MFG. Co., that city. JOSEPH W. MOLLEK, JR., and JOHN R. EVANS will be president and treasurer, respectively, of the new company. The management of the new firm will retain the present operating personnel of the Kidde Precision Tool Corporation, and will continue to occupy the existing plant facilities located on Locust Ave. in Roseland.

Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has announced that HENRY A. STURM has been appointed product sales manager of tool steel. Mr. Sturm joined Crucible in 1937, serving in various sales executive capacities. D. W. KAUFMANN has been made product manager of stainless steels. In his new capacity, Mr. Kaufmann will also be responsible for vacuum-melted high-temperature alloys, superalloys, and titanium.

AIR REDUCTION SALES CO., a division of AIR REDUCTION CO., INC., New York City, has named R. H. MERRIMAN district manager of the Philadelphia, Pa., office. J. W. CUNNINGHAM has been appointed manager of the district sales office in Pittsburgh, with the direction of the sale and distribution of all Airco products marketed through that area.

FIRTH STERLING INC., Pittsburgh, Pa., has announced the following appointments in the carbide division sales organization: KENNETH E. MCKOWN has been promoted to Pittsburgh district manager. PHILIP



ON LAND
ON SEA
IN SPACE

Performance is Better with

JERPBAK BAYLESS

34170 Solon Rd.
Cleveland 39, Ohio

ACTUATOR SCREW and NUT ASSEMBLIES

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GEARING FOR PROFITS?

Check Your Gear & Rack Requirements with Braun First!

The direct action of sending prints with a request for quotation costs you nothing and may mean new savings for you in your gear purchases.

Send for our explanatory brochure "Gearing For Profits."

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BRAUN GEAR COMPANY
243 Richmond Street
Brooklyn 8, New York

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Just $3.00 **If YOU Bend or Cut** Just $3.00

think of how fast you could get $3.00 back. That's what the 196 page (156 illustrations and charts) "A Manual of Processes for The Cold Bending of Metals and Abrasive Cut-Machining of Metals" costs.

Written for shop men by shop men.

WALLACE SUPPLIES MFG. CO.

1310 West Diversey Parkway Chicago 14, Illinois

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INSTA Hold-Down CLAMPS

"Clamps Without Shims"

Holds work securely on: Jig Borers • Planners • Punch Presses • Drill Presses • Mills • etc.

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Unconditionally Guaranteed!

Insta clamp COMPANY

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Greenerd PRESSES

• FORMING • STRAIGHTENING • SIZING • STAMPING •

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- **ASSEMBLING**
- **BROACHING**
- **EXPANDING**
- **FORMING**
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ETC.

GREENERD hand operated Arbor Presses are built in plain lever type, lever ratchet type, and larger sizes compound geared with two pinions meshing with the rack. Smaller sizes may be furnished with pilot wheel in place of lever.

Write for Catalog M-42.

GREENERD Hydraulic Presses are used for push broaching, forming, straightening, testing of dies, and many other uses, as well as production assembly work.

Write for Catalog M-46.

#1—2 Ton Fast Hydraulic Press
#2—Metal Expanding Machine from 40-300 Ton Capacity
#3—Arbor Presses ¼ to 30 Ton
#4—Guided Platen Hydraulic Presses
#5—C-Clamp Hydraulic—2 to 30 Ton
#6—Straightening Press—15 Tons Spring centers on ball bearings

Sold by Machine Tool Dealers and Mill Supply Houses throughout the world.

Greenerd ARBOR PRESS CO.

41 CROWN ST. NASHUA, N.H.

For more data circle Item 241E

AUTOMATIC FLASH REMOVAL SETUP for die-cast zinc carburetor parts. Two brushing heads—each made up of seven Osborn Master® Wheel brushes—are mounted over the conveyor. Parts (shown fixtured in lower left corner) pass under brushing heads where all flash is removed as they travel to next work station.

OUTPUT TRIPLED from 200 to 600 an hour with OSBORN power brushing

Before: this auto equipment maker was using costly off-hand methods to remove flash from these die-cast zinc carburetor parts. Production was slow . . . it varied from shift to shift, averaging about 200 pieces per hour.

Now: parts are Osborn power brushed clean as they travel between work stations by conveyor . . . *eliminating manual handling.* The setup of Osborn Master® Wheel brushes does the job at rates up to 600 pieces per hour . . . *three times as fast.* The operation is simple, inexpensive. Results are uniform, with excellent quality control.

This application is typical of how *your* tough metal finishing problems of every description—deburring, cleaning, polishing, precision blending—can be solved with today's Osborn power brushes and brushing methods. An **O**sborn **B**rushing **A**nalysis—made at no obligation in your plant now—is the first step. Write or call *The Osborn Manufacturing Company, Dept. D-63, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

Osborn Brushes

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

L. ZANELLO has been named division sales engineer in the Pittsburgh district office. He will cover the Buffalo and Rochester areas of New York state.

Appointment of ROBERT N. BOUCHER as regional manager of the newly created Philadelphia, Pa., sales region is announced by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio. The new region, with headquarters office at 3701 N. Broad St., Philadelphia 40, is comprised of eastern Pennsylvania, southern New Jersey, Delaware, Maryland, and Washington, D. C.

PAUL M. HERRING has been named president of the KUTZTOWN FOUNDRY & MACHINE CORPORATION, Kutztown, Pa., succeeding his father, EDGAR W. HERRING, who has resigned. The new president was chief accountant for the firm from 1941 to 1949 and had served as vice-president and assistant treasurer since 1950.

E. W. BLISS CO., Canton, Ohio, announced the appointment of STEVE STASKO as chief metallurgist of the MACKINTOSH-HEMPHILL DIVISION, Pittsburgh, Pa. He succeeds EDWARD P. SANDBACH, who was recently promoted to manager of manufacturing operations.

The promotion of LESTER T. YEAGER to the position of general sales manager has been announced by TEXTILE MACHINE WORKS, Reading, Pa. Mr. Yeager was formerly manager of the wire products division.

Japan

LANDIS TOOL CO., Waynesboro, Pa., announced the appointment of TOYODA TSUSHO KAISHA LTD., machinery department, 221-1, Sasashima-Cho, Nakamura-Ku, Nagoya, Japan, as its distributor for Landis precision cylindrical grinders in that country.

New Books

BROACHING—TOOLING AND PRACTICE. By Horace E. Linsley. 216 pages; 6 by 9 inches; 162 line and halftone illustrations. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $6.50.

This well-illustrated book brings together a wealth of technical and general information covering the

entire field of broaching—internal, external, vertical, and horizontal. It describes in detail how each type of broaching machine operates and the types of work for which each is best suited. Various kinds of broaching operations such as spline broaching, gear broaching, rotary broaching, continuous or chain broaching, and horizontal surface broaching are explained. Examples are also given of special and unusual broaching operations. The design of broaching tools is covered in detail and a separate chapter is devoted to broaching fixtures. A chapter on setting up and trouble shooting is also included.

This book will be helpful to those in the metalworking field who have not fully investigated broaching possibilities as a means of reducing production costs. Tool and manufacturing engineers will also find the book of considerable interest. It should provide good source material for engineering college and technical institute courses which deal with manufacturing processes, machine tools, tool design, and cost reduction programs.

AWS Definitions — Welding and Cutting. Prepared by the the AWS Committee on Definitions and Symbols. 59 pages; 6 by 8 7/8 inches; illustrated. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $2.

The AWS Committee on Definitions and Symbols has prepared this book in order to provide standard nomenclature and definitions for terms relating to new welding developments adopted since 1949, and to improve the terms and definitions relating to the older welding processes. Approximately half of the book is comprised of an alphabetical list of terminology. The other half is devoted to diagrams illustrating the terms used.

American Standard Ball and Roller Bearings and Parts. ASA B3.7-1960. 31 pages; 8 1/2 by 11 inches. Published by the American Standards Association, Inc., 10 E. 40th St., New York 16, N. Y. Price, $2.

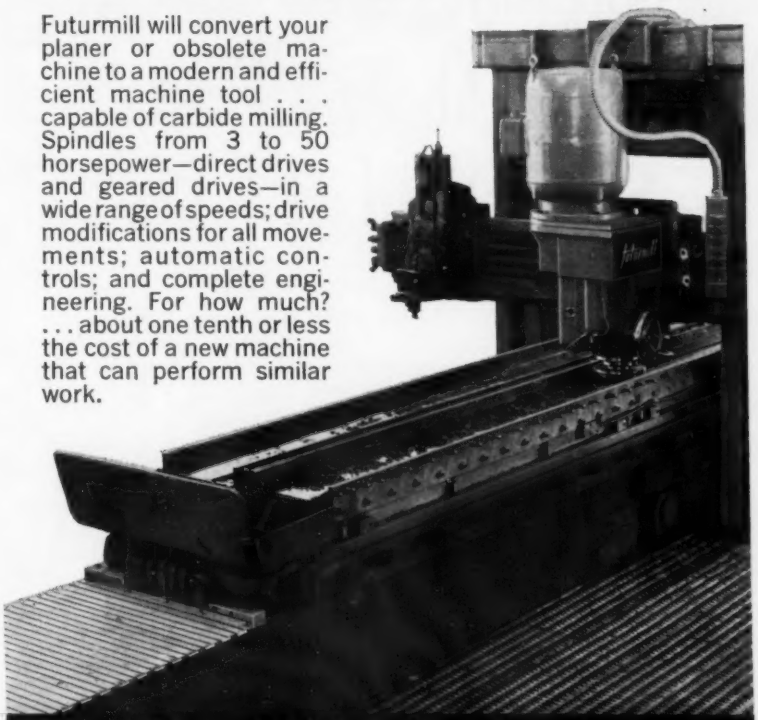
This standard defines the terminology of ball- and roller-bearing parts, dimensions, tolerances, measurements, etc., and so provides the basis of a common language, thereby lessening the chance of misunderstanding between users and producers of ball and roller

MACHINES THAT PRODUCE PROFIT . . .

Seventy Futurmill planer conversions remove more metal per hour than **Seven Hundred** unconverted planers of the same size and make

One company reports that a job previously estimated at thirty-three hours planing time per piece was reduced to four hours actual machine time per piece with their Futurmill conversion. The savings derived from the one job of 120 pieces more than paid the entire cost of converting the planer. Others report equally substantial savings in time; greater production capacity for one machine; and the discovery of many new applications for converted machines.

Futurmill will convert your planer or obsolete machine to a modern and efficient machine tool . . . capable of carbide milling. Spindles from 3 to 50 horsepower—direct drives and geared drives—in a wide range of speeds; drive modifications for all movements; automatic controls; and complete engineering. For how much? . . . about one tenth or less the cost of a new machine that can perform similar work.



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bearings. The first part of the standard contains the terms (arranged alphabetically), their definitions, and, in most instances, a key figure number which enables the reader to see the term referred to in an illustration. The illustrations comprise the latter half of the standard. The Anti-Friction Bearing Manufacturers Association, Inc., is the sponsor of this standard.

Coming Events

MARCH 20-24—Twelfth Western Metal Exposition and Congress, sponsored by the American Society for Metals, to be held in Pan-Pacific Auditorium, Los Angeles, Calif. For more details, contact T. C. DuMond, ASM manager of Metal Congresses, American Society for Metals, Metals Park (Novelty), Ohio.

MARCH 27-28—Third Annual Production Institute, sponsored by the American Society of Tool and Manufacturing Engineers, to be held on the campus of the University of Wichita, Wichita, Kan. For more information, contact Professor B. M. Aldrich, coordinator, University of Wichita, Wichita 8, Kan.

APRIL 18-20—Annual Welding Exposition, sponsored by the American Welding Society, to be held at the New York Coliseum. Concurrently (April 17-21), the society will hold a technical meeting at the Commodore Hotel, New York City. For more details: AWS Information Center, American Welding Society, 33 W. 39 St., New York 18, N. Y.

MAY 22-25—Design Engineering Show, to be held in Cobo Hall, Detroit, Mich. For further detail, inquire of Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 22-26—ASTME Tool Show, to be held in New York Coliseum. For additional information, contact Leonard Abrams, American Society of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.

• • •

American Society for Metals Will Present $30,500 in Engineering Scholarships

A total of $30,500 in college scholarships to student metals engineers will be presented this year by the American Society for Metals' Foundation for Education and Research. Equal awards of $500 will be given to metallurgical students

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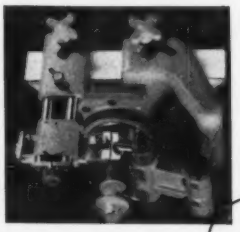

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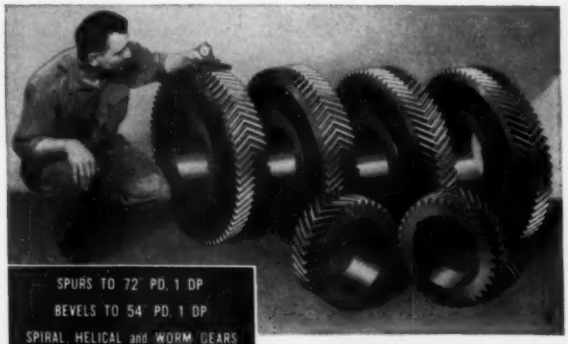

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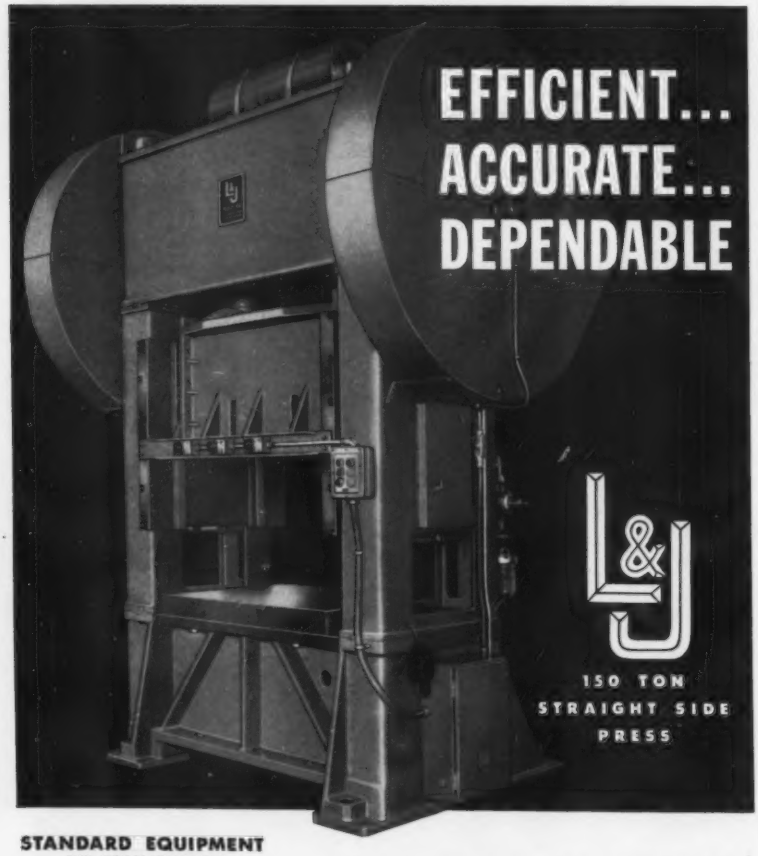
at sixty-one different participating colleges and universities throughout the United States and Canada. Winners of the scholarships are chosen by the schools themselves, and they receive a certificate in addition to the cash award.

The ASM Foundation for Education and Research was established in 1953 to recognize outstanding achievement in the study of metallurgical engineering, and to encourage more students to enter this important profession. The $750,000 foundation is the largest ever established by a technical society from its own resources for the benefit of qualified aspirants.

Including the 1960-1961 winners, 428 engineering scholarships have been awarded by the 33,000-member metals society for a total of $189,-200. Dr. William A. Pennington, head of metallurgy at the University of Maryland, is president of the society, and Walter Crafts, associate director—technology, Union Carbide Metals Co., Niagara Falls, N. Y., is president of the education and research foundation.



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New Standards Cover Grinding-Wheel Shapes and Sizes

The Grinding Wheel Institute, Cleveland, Ohio, has announced approval by the American Standards Association of new standard specifications for shapes and sizes of grinding wheels. The standards classify according to twelve end-use categories. Shapes and sizes of wheels have been included only after determination on the basis of sound engineering practice, whether or not the wheels were designed dimensionally to perform the job for which they are intended. The new publication is entitled "American Standard Specifications for Standard Shapes and Sizes of Grinding Wheels, B74.2-1960."

° ° °

Film Strip on Die Sets

A technical film strip with sound shows how die sets serve modern mass-production industries. It also shows how die sets themselves are manufactured, step by step, at the Producto Machine Co. plant. Titled "Mass-Production Insurance: the Dependable Die Set," the film was photographed largely in the company's foundry and manufacturing facilities in Bridgeport, Conn.

The fifteen and one-half minute, 35-millimeter film strip with record is ideal for showing at appropriate gatherings of industrial associations.

The film and talk will be presented upon request at meetings throughout the United States by Producto representatives. Requests and inquiries should be directed to P. R. Marsilius, executive vice-president, Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn.

° ° °

Welding Competition Open to High-School Students

High-school students will be eligible to compete in a $15,000 national welding competition sponsored by the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. Awards will be given to full-time day high-school students who prepare and send to the foundation the best descriptions of how arc welding was used on a school-supervised project for maintenance, repair, or construction. Projects may be made either by individual students or by groups of two or three students. June 12 is the closing date for entries in the contest.

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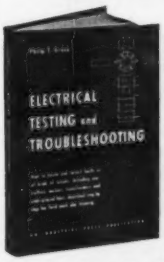

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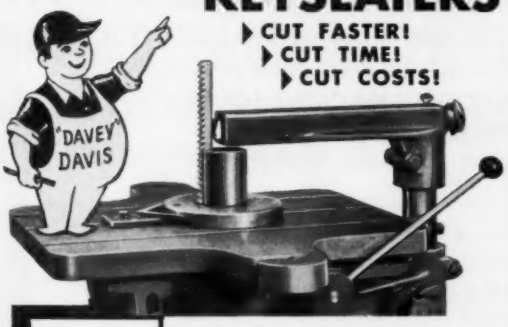

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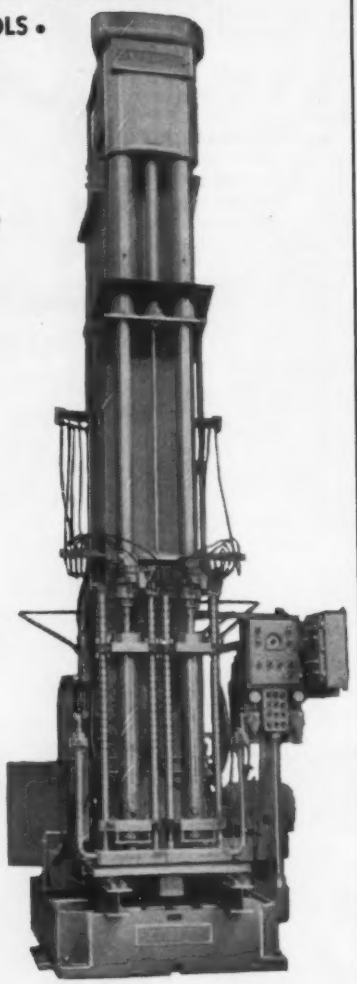

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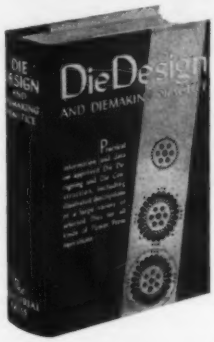

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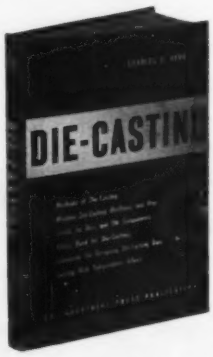

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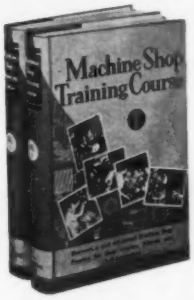

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LIQUIDATION EAST LEHIGH NAVAL ORDNANCE PLANT

Applebutter Road, Bethlehem, Penna.

MACHINE TOOLS • FORGING EQUIPMENT • FURNACES • HEAT TREATING

MOST EQUIPMENT USED ONLY TWO YEARS OR LESS

BLOWERS
7—Allen Billmeyer 100 CFM, Turbo, 50 HP
5—Clarage No. 2½ M.D. 30 HP
20—G.E. 450, 10,000-3000 CFM, A.C. Motors
9—Spencer Turbo, 2000 CFM

BOILERS
2—B&W 4000 HP, Type F 175 PSI, 475°F., 150,000 lbs./hr., oil and pulverized coal, all aux. equip.

BLAST CLEANING EQUIPMENT
1—American Pressure Blast Cabinets, Dust Collector
1—Pangborn Type ES—140 Air Blast Cabinet
1—Pangborn Type ES—141 Airless Rotoblast Cab.

BORING MILLS, HORIZONTAL
Moline 4" Hydraulic Floor Type 3'x10'

BURNERS—FURNACE
50—Hauck #782
525—Duradiant #670
75—Hauck Atomizing #790
125—Hauck #668
500—Hauck #700
100—Hauck #780

CENTERING MACHINES
3—Frew Centering Machine Hydraulic
1—Stoker Simplex 3U

CHARGING MACHINES
3—Brosius 6,000 lb., Auto Floor on Rubber Wheels
1—Brosius 15,000 lbs., Floor on Rubber Wheels

CRANES—HOISTS
93—500 lb. Sheppard Niles Electric Hoists, Plain Trolleys, D.C.
45—4000 lb. Sheppard Niles Electric Hoists, Motor Driven Trolleys, D.C.
75—24' & 30' wall type jib cranes for above hoists
15—Pillar type jib cranes for above hoists, 12' to 18'
10—G.E. radial hoists for handling hot forgings

DRAW BENCHES
5—Bethlehem 100 ton, 11'6" stroke, hydraulic

DRILL PRESSES
Barnes Model #210, Box column, P.F.
Demco ⅝" Hi speed sensitive single spindle

DUST COLLECTOR
No. 20 Rotocleone Type D—Exhauster Collector

FLOOR PLATES
12—10'x14'x26"—50,000 lbs each
1—12'x40'x26"—190,000 lbs.

FURNACES—HEAT TREATING—LEAD POTS
10—Carbottom Recirculating Furnace 14'x50'
2—Flame Hardening 12'x15' with gas trans. system, Mixing Machine and After Coolers
1—Bung top heat treating furnace, 14'x108', including Pyrometer, Seal Plates and Blowers
10—14'9"x18' hearth type Reheat gas or oil
2—Mahr Double Chamber Oil Fired Forge Furnaces
3—Mahr #415 Steel cased and insulated oil fired
1—Gas Fired Die heating furnace
10—Bung top heat treating furnace, 11'x40'
10—G.E. Single Compartment intermittent conveyor type electric 8'x45' with pushers and shoes
10—G.E. Lead Pots 36"x72" with Radial Hoists, 18" grabs, 42" hydraulic lift electric trolley
4—General Electric RS-24 Box type electric furnace
6—Oil or gas fired draw furnaces
4—Oil or gas fired draw furnaces
4—Oil or gas 10'x12'10" annealing or forging
4—Oil or gas fired, bung 9'x12' for heat treating or forging
6—Bell bung top heating, blowers and controls, gas or oil
4—G.E. Rotary furnaces complete with charging, discharging and control equip., auto., 20' dia
8—G.E. single compartment conveyor type draw furnaces 8' wide, 12'5" long x 15" double door
4—Dip tanks 9' long x 4' wide x 3½' high
12—G.E. Conveyor type single compart. heat treating furnaces, 8' x 13'5" x 15", double door
1—G.E. PRB #18 Box Type Electric
2—Electric solder heating pots
5—Salem oil or gas rotary forge or heat treating with charging and discharging tongs, conveyors
1—Type H Salt Bath furnace complete
1—Type P Salt Bath furnace complete
3—Vetrical Air Draw furnaces

GRINDERS—PLAIN
4—Fitchburg 10"x48" model B hydraulic
2—Norton 10'x48"
1—Norton 24'x96"

GRINDERS—TOOL AND CUTTER
8—Bridgeport 4½ wet tool grinder, 30" Blount 30" wet tool grinder
2—Ex-Cello #46 double end carbide Ex-Cello #49 heavy duty double end carbide
2—Cincinnati #2 Universal, tool and cutter
1—S-U Hisey Wolf, 3 HP, double end pedestal Boggis 700 tap grinder
2—Seller 4T universal tool bit 6" Hammond double end pedestal 4" Hammond double end carbide, M.D.

GRINDERS UNIVERSAL
2—Landis 14" x 72" type C hydraulic—internal
2—Norton 14" x 72" type C hydraulic—internal

GRINDERS—MISCELLANEOUS
Ex-Cell-O 35L Universal Thread
LG2 Stows Flexible shaft grinder pedestal

HAMMERS
2000 lbs. Erie Double Frame Steam Forging
6000 lbs. Chambersburg Steam Double Frame Forging
8000 lbs Chambersburg Steam Double Frame Forging

LATHES—AUTOMATIC
Fay 12"x21", front and back slide, 12" 3-Jaw chuck
Sparks semi-automatic hydra-feed, 21"x52"
B&B semi-automatic hydraulic, 12"x36"

LATHES—BORING, CENTER DRIVE
1—Niles 47"x33'4"x33'4", dbl. end hollow spindle
9—Wicks 30"x25'x25', double end hollow spindle
2—Hepburn hand turning lathe, 14'x24', M.D.

LATHES—ENGINE
American 24"x72"
American 24"x101", geared anti-friction, M.D.
4—American Pacemaker 20x48, profile Att., Timken
2—LoBlond 20"x120", Timken, P.R.T., taper
2—Niles 30"x108" Time Saver, anti-friction P.R.T.—tracing
2—Niles 30"x120" Time Saver, anti-friction, P R.T.—taper
Mackintosh-Hemphill 60"x60", anti-friction, P.R.T.
Mackintosh-Hemphill 94"x30", P.R.T., Anti-Friction
2—Monarch 27"x60" Model N, Timken sizing
Monarch 24"x60" Model N, Timken tracing
Monarch 27"x108" Model N, Timken
Sydney 30"x84" Herringbone anti-friction taper
7—Simmons 48"x20', Herringbone anti-friction taper
Sommerfeld 52"x76" Timken—2 carriage, P.R.T.
Sommerfeld 60"x36' bd., Timken—2 carriage, P.R.T.

LATHES—BORING & TURNING
Sommerfeld 50"x60', Timken screw cut.—P.R.T.
Sommerfeld 50"x76', Timken screw cut.—P.R.T.
Sommerfeld 50"x80', Timken screw cut.—P.R.T.
2 Betts Bridgeford 60"x80', 2 carriage, P.R.T.

LATHES—TURRET
4—3A—Warner & Swasey chucker—6¼ hole
8—4A—Warner & Swasey, 9" hole chuckers
3B—Gisholts chucker, 5¼" hole
3—3R Gisholts chucker, 5¼" hole screw cutting
4—4R Gisholts chucker, 9½" hole
2—4R Gisholts chucker, 9½" hole screw cutting
1—4R Gisholts chucker, 9½" hole 6' long screw cut

LIFT TRUCKS
1—6000 lbs. Yale K41 center control ready power
5—10,000 lbs Yale low lift ready power

MILLER TREADS
2—Hall Style D planetary
2—Hansen & Whitney—10x48
3—Loss Bradner—12x24 HT
3—Smalley General #27, M.D , Internal

MILLING—MISC.
2 Root, 3 Way Automatic with 3 verticals, M.D., paced 120 degrees apart auto. cycles

MILL
Salem Witter 5' Tube Processing

MOTOR GENERATORS
Westinghouse (1) 125 HP; (1) 100 HP; (1) 75 HP; All 220 variable voltage

PLANERS
4—Mesta 6'x35' Post
2—Mesta 14'x35' Pit

PLATE HARDENING
Plate hardening furnace, 12'x15' gas transmission system mixing machines, after cooler, Spray quench water 12'x30'

PRESSES—HYDRAULIC
400 Ton Bethlehem, 4 post down moving bed 95½x45", Stroke 42"
300 Ton Wilson Forging Press, six position turret type Ram head, 2 work holder auto. load and unload
2—400 Ton United down moving 3 rod forging, 100" dia., turret indexing 4 pos. bed, stroke 48"
1,000 Ton Watson Stillman straightening—four rod type—bed 86x72—Ram 42"x72"—Stroke 48" with traveling bed and work rotators

6,500 Ton Mesta Down Moving 4 rod self-contained forming — bed 15'x15' — Ram 7'6"x16'—Stroke 60"—Daylight 84

PRESSES—STRAIGHT SIDE—GAP FRAMES
207½ Bliss single crank tie rod trim side shear—235 tons
1—509 Bliss geared tie rod single acting 415 tons—for billet breaking—auto. load and unload

PRESSURE VESSELS
4—A. O. Smith Hydro-pneumatic accumulators 2,400 gallons at 2865 PSI, 42" LD x 23'3" SS x 3-13/16

PULVERIZERS
2—B&W Ring Roll, 35 ton/Hr.
1—Jeffrey 24"x20" Rotary ring crusher, 70 HP.

PUMPS
LaBour size 25 type DPL, 200 GPM, 10 HP.
2—Byron Jackson vertical deepwell type 8K centrifugal, 6000 GPM, 300 HP
2—Pennsylvania, 500 GPM, 30 HP. centrifugal
2—Drawo single stage, double suction centrifugal
3—Byron Jackson 1½" BNL Bilton pumps
2—GALV 1500 GM Ingersoll Rand
5—Bethlehem 450 GM Triplex, 2,500 PSI, 800 Syn. HP.
5—Worthington, 300 Syn. HP, 2,500 PSI, Triplex

QUENCHING EQUIPMENT
Circulating quench tanks with conveyor
Circulating tanks with manual handling equip.
Handling equipment for oil, water, brine
General Electric spin quench oil, water, brine
Rotating quench hoshes

SAWS
8—Marvel 9H High Speed heavy duty
3—Newton 32" heavy duty hydraulic
2—Racine 33-CX 12"x16" hydraulic shear cut

SHAPERS
2—24" Rockford Hydraulic Universal
1—24" Steptoe Heavy Duty Universal

STACKS AND FLUES
5—Ind. Heat Flues; Stack 4' I.D. x 107' ceramic

TABLES
2—Die Turn Tables 21"x26"
Billet transfer table with roller table 3'8" roller table

TANKS
1,000 gallon gasoline with Bonnet pump
13—Water, Oil Sludge, Dip Tanks

TESTERS
Bethlehem Pull Tester
Gogan—Model 1618 and Model 330 Brinell
Tinius Olsen No. 2 Standard
4—Shore Model C Scleroscope
2—Shore Model C-2 Scleroscope

TIRE SETTERS
4—West Hydraulic Tire Setters capacity up 20"

TRANSFORMERS
1000 KVA AC 11000/440/220

UNIT HEATERS
10—Crane Model 315 FBS, 1,500,000 BTU/HR
5—Webster Model 3995-4, Giant units

MISCELLANEOUS
2—16' Brassert Automatic self-cleaning water strainer; Jeffrey Coal Elevator; G.E. 70 HP. D.S.-114, 3,600 RPM Steam Turbines; 6—18" Westinghouse Search Lights; Tyman daters; 2—75 ton Morgan turning riggings, lifting rig and hooks and chain; 2—150 ton motorized transfer cars and track; 1—Model 804-2150 air reduction travograph with magnetic tracing device and table complete with 8 radiograph burners; 29—Pyrometers; Testing Cradle; Concentricity Gauges; Fairbanks Model No. 1170—1,500 lbs. scale; Up-Ending machines; Roll over stands; Shell lifter; 40—30" Buffalo type man coolers; 5—Ross 900 sq. ft. vertical oil coolers; Soldering rack and pot; DiVilbiss spray painting unit; Electric solder units; Boresscope 20' x 1¾" with retriever; 12" x ⅜" with retriever; Slag Plier; Spray Pipe and mast; Machine Vises 4-6-8"; Copper oxide battery charger; 3-6" Sheffer-Gross No. 930 Sylphone temp. regulators; 3—500 lb. Double Rated Airco Acetylene Generators; Lifting Tongs 6" to 16" Auto and Chain; Chip Boxes; Circuit Breakers; Tote Boxes; Gas Converters; Detroit Degreaser Model 325; 5—Hydraulic Descalers up to 16" Billet; Turret Lathe Tooling; Atlas #25 Arbor Press; Storage Cabinets and Bins; 1500' Matthews 10' Section Roller Conveyor; Monorail 6"x10" Beam; 3—1400' Overhead Conveyors; Fire Brick.

MACHINES AT OTHER LOCATIONS:

1—LAKE ERIE 75 Ton, 100" Stroke, Draw Bench
1—80" ESPEN LUCAS Cold Saw
3—KEARNEY & TRECKER 5H Plain Milling Machine, Vertical Heads
2—KEARNEY & TRECKER 4K Vertical Mill
2—BARNES Center Col. Inverted, 3 Spindle, 6 Station Drill
1—165 TOLEDO Double Action Toggle Press, 125 Tons
1—1200 KVA Flash Butt Welder, 850,000 lbs. Upset, 303000 Amps
1—4A WARNER & SWASEY extra long bed, 8" hole, 4 jaw chuck, threading and taper attachment, tooling
1—560T GIDDINGS & LEWIS 6" Bar Table Type Horizontal Boring Mill, High-Speed Spindle, New 1946
1—16 x 168 CINCINNATI Model QM Plain Grinder, 1946
2—BULLARD Cutmaster 54", 36" Side Head Chucks, All 1946
1—BULLARD 30" Man-Au-Trol with Side Head, New 1950
1—36" ROCKFORD Hydraulic Openside Shaper Rail & Side Head, New 1948
1—CONSOLIDATED Coburn 84" Heavy Duty Vertical Boring Mill, 2 Ram Heads, Side Head, Spiral Drive, Flat Track, Anti Friction Table Bearings

Contact: Mr. Rankin Johnson, Jr., P. O. Box 1216-D Bethlehem, Penna. Phone: UNiversity 5-0766

LURIA INDUSTRIAL DIVISION

Nearly New (Up to 1955)

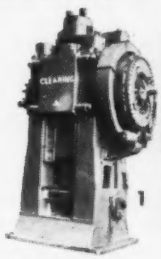
FORGING and STAMPING Equipt.

at a fraction of new cost... Save up to 2/3rd.

- LATE MODELS • LOWER CAPITAL INVESTMENT
- MONEY BACK GUARANTEE • INSPECTION UNDER POWER

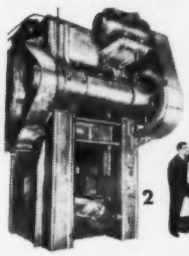
FORGING PRESSES

Suitable for Hot Forging, Coining, Blanking, Forming and Impact Extruding. All presses have Air Clutch and Brake. Most have positive Knock-outs in bed and slide, and power operated Die Seat (Wedge) adjustment.



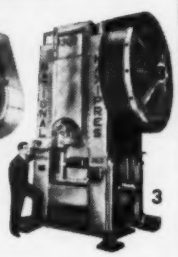
1

1600 Ton CLEARING
1952
Selling Price **$90,000**
New Price $200,000 (approx.)
Mdl. EF-1-1600, Bed 42"x66" 12" Stroke, 65 Str. pr. min.



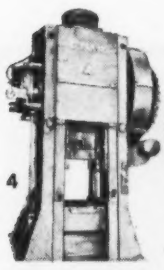
2

1600 Ton BLISS
1952
Selling Price **$90,000**
New Price $200,000
Mdl. FS-1-1600, Bed 38"x48" 12" Stroke, 70 Str. pr. min.



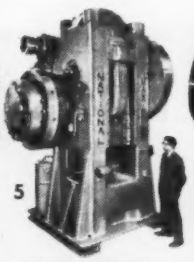
3

1300 Ton NATIONAL
1955
Selling Price **$49,500**
New Price $133,000
No. 1300 Maxipres, 10" Stroke, 80 Str. pr. min.



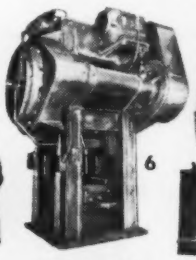
4

750 Ton CLEARING
1952
Selling Price **$36,500**
New Price $75,000
Mdl. EF-1-750-27½, 8" Stroke, 80 Str. pr. min.



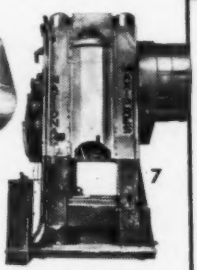
5

750 Ton NATIONAL
1943
Selling Price **$25,000**
New Price $70,000
No. 3 Maxipres, 10" Stroke, 50 Str. pr. min.



6

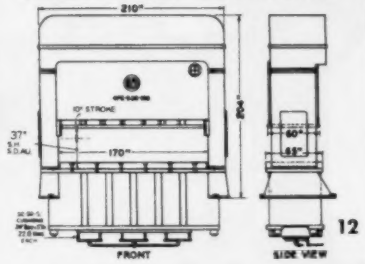
750 Ton BLISS
1952
Selling Price **$36,500**
New Price $75,000
Mdl. F-51-750, Bed 26"x34", 6" Stroke, 85 Str. pr. min.



7

1200 Ton NATIONAL
1943
Selling Price **$49,500**
New Price $132,000
No. 4 Maxipres, 8" Stroke, 80 Str. pr. min.

WIDE BED PRESSES

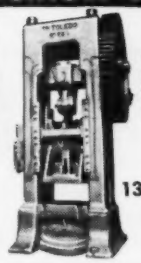


12

380 Ton BLISS
Bed Area: 170" x 65"
Selling Price **$35,000**
New Price $95,000

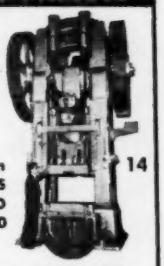
3 Presses available. Cushions extra. Mdl. 4FE-380-168, 10" Str., 18 Str. pr. min. For Blanking, Drawing, Forming and Progressive Die Operations.

SINGLE CRANK PRESSES



13

440 Ton BLISS TOLEDO No. 59¼



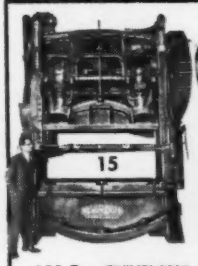
14

920 Ton BLISS TOLEDO No. 60

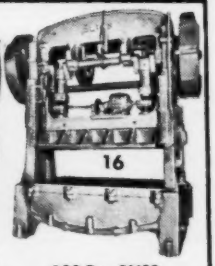
Selling Price **$12,500**
New Price $50,000
Bed 41"LR x 48"FB, 12" Str., 29" S.H. Air Clutch, Air Cushion.

Selling Price **$25,000**
New Price $110,000
Bed 46"LR x 72"FB, 20" Str., 36" S.H. Air Clutch, 14 SPM. For Blanking, Trimming, Coining, Impact Extruding, Drawing.

DOUBLE CRANK PRESSES



15

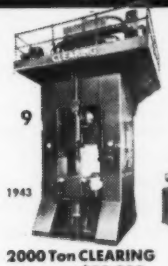


16

150 Ton CLEVELAND
60-D-84
Selling Price **$8,500**
Replacement Cost $40,000
Bed 86"LR x 46"FB, 14" Str., 31" S.H. 33 SPM. Air actuated friction clutch. For Blanking, Drawing, Forming, Die Tryout.

100 Ton BLISS
Consolidated No. 166D
Selling Price **$7,500**
Replacement Cost $40,000
Bed 84"LR x 48"FB, 12" Str., 30" S.H., 17 SPM. Air Clutch. For Blanking, Drawing, Die Tryout.

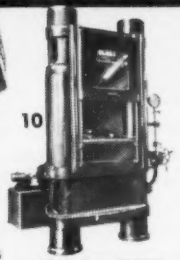
HYDRAULIC PRESSES



9

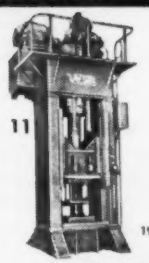
1943

2000 Ton CLEARING
Selling Price **$30,000**
New Price $130,000
Mdl. H-2000-54, Bed 56"LR x 48"FB, 18" Down Str., 64" Open Ht., 230 HP. Speeds (in./min.): 900/600/35. Two presses on orig. foundations. For Drawing, Forming, Piercing, Coining, Hobbing and Blanking.



10

1500 Ton ELMES
1952
Selling Price **$12,500**
New Price $40,000
Mdl. 4477, 12" up-stroke, 33" daylight, 3 post constr., 34½" bet. posts. For Hobbing, Drawing, Forming, Coining and Blanking.



11

1944

350 Ton VERSON
Selling Price **$15,000**
New Price $35,000
Mdl. 350 HD4CT, 32" Down Str., Bed 40"x40", 70" Daylight, 125 HP. Speeds (in./min.): 685/914/76. For Blanking, Forming, Coining and Impact Extruding, Drawing.

8

3000 Lb. "Coca-Drop" HAMMER
1951
Selling Price **$17,500**
New Price $32,000
Chambersburg Mdl. 30CD, Air or steam lift. Gravity drop forging hammer.

We pay highest prices for your surplus presses

Phone TRinity 2-1270 **Cable Address: "Wenderpres" U.S.A.**

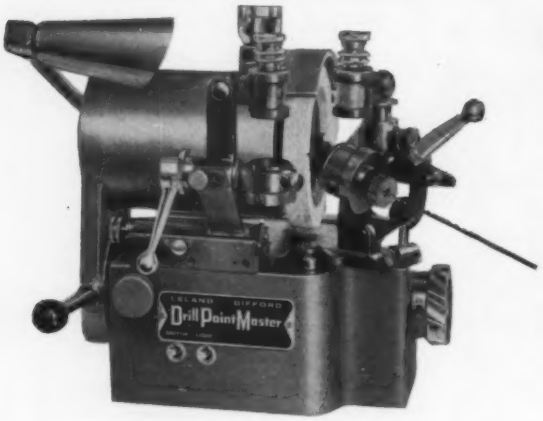
Wender PRESSES, INC.

1957D CLAY AVE. • DETROIT 11, MICHIGAN

Check appropriate square and clip to business card or letterhead for specifications. ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10 ☐11 ☐12 ☐13 ☐14 ☐15 ☐16

Check here for complete stock and price list ☐

NEW LELAND-GIFFORD DEVELOPMENTS TO HELP IMPROVE YOUR PROFIT PICTURE



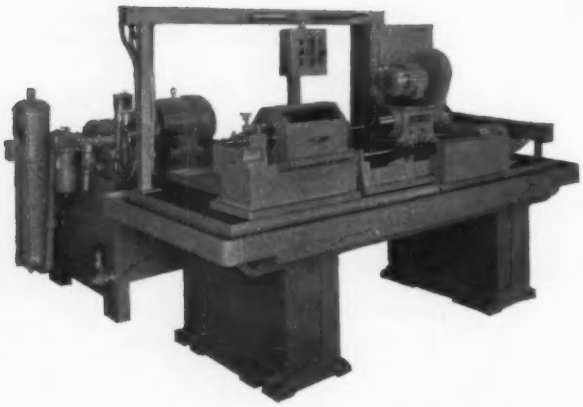
UNIQUE NEW DRILL SHARPENER

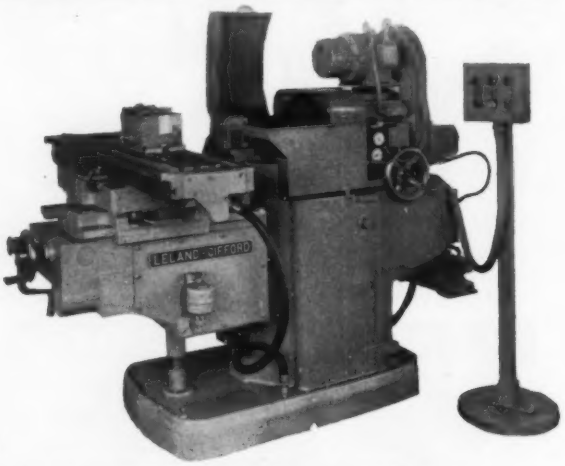
- Duplicates Any Point Geometry
- Sharpens, Relieves and Thins with Micrometer Accuracy
- Gives You Longer Drill Life; Cleaner, Truer Holes; More Drilling Production

This completely new concept in a precision drill grinder is capable of producing or reproducing any desired point on any drill from #80 to .250″ diameter. The Drill Point Master will dramatically improve all your drilling operations and is often the only solution to drilling true holes in super alloys and exotic materials.

NEW GUN DRILLING EQUIPMENT

- For Drilling Deep Precision Holes up to ¾″ Diameter
- Available in Knee or Horizontal Type
- With Hydraulic or Lead Screw Feed





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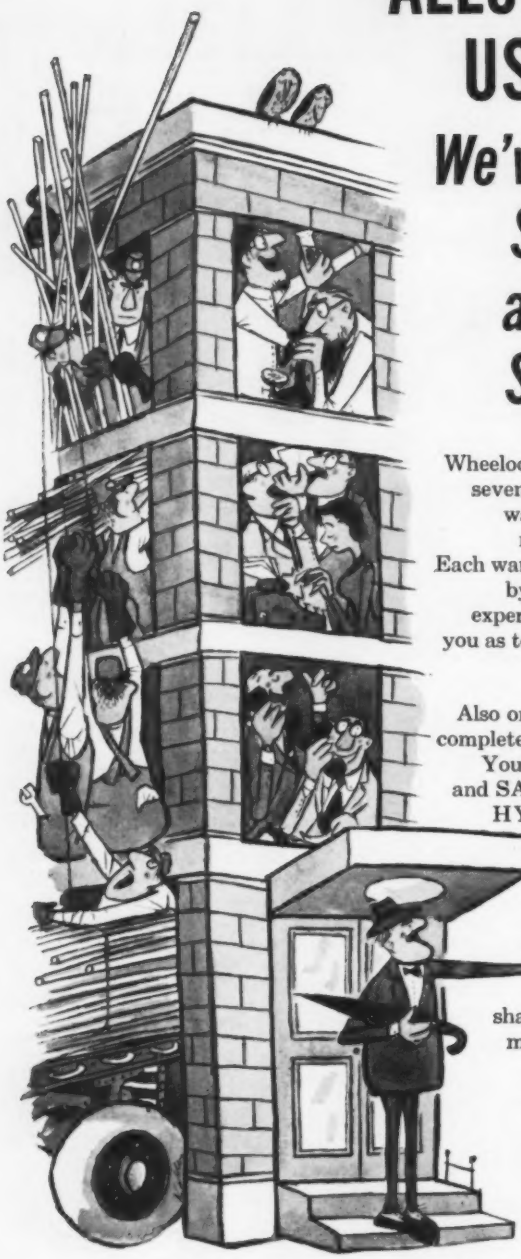

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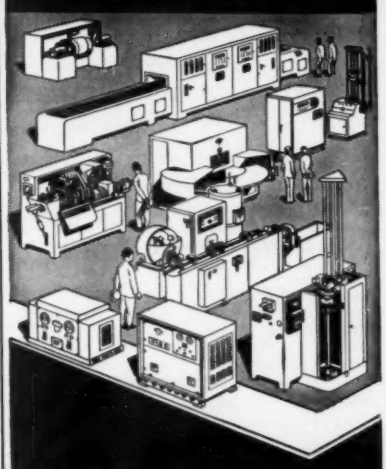

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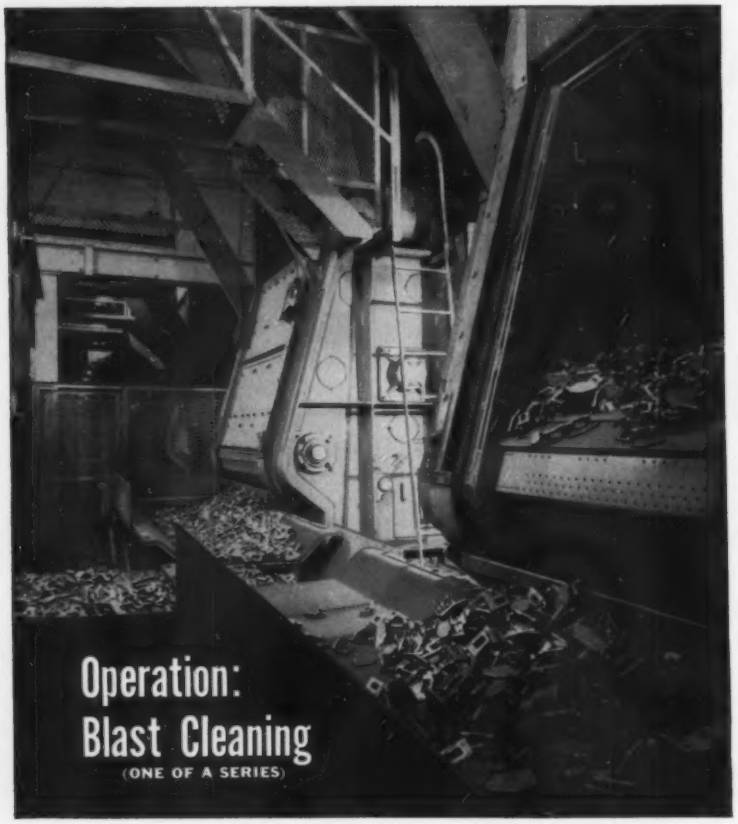

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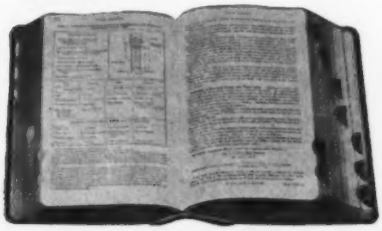

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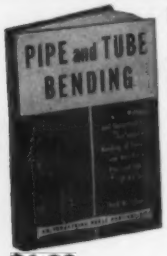

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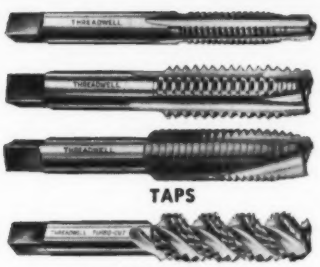

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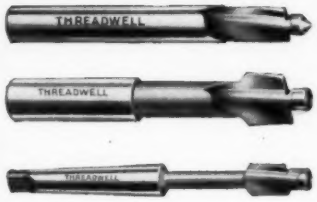

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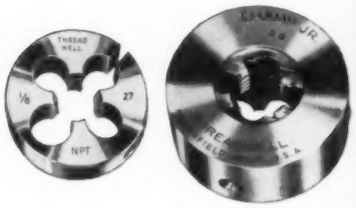

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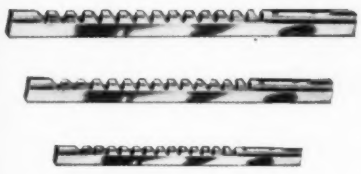

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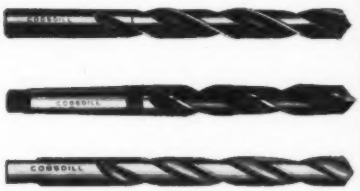

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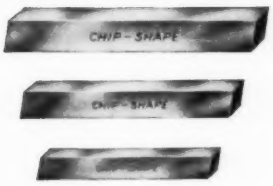

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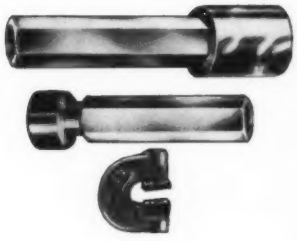

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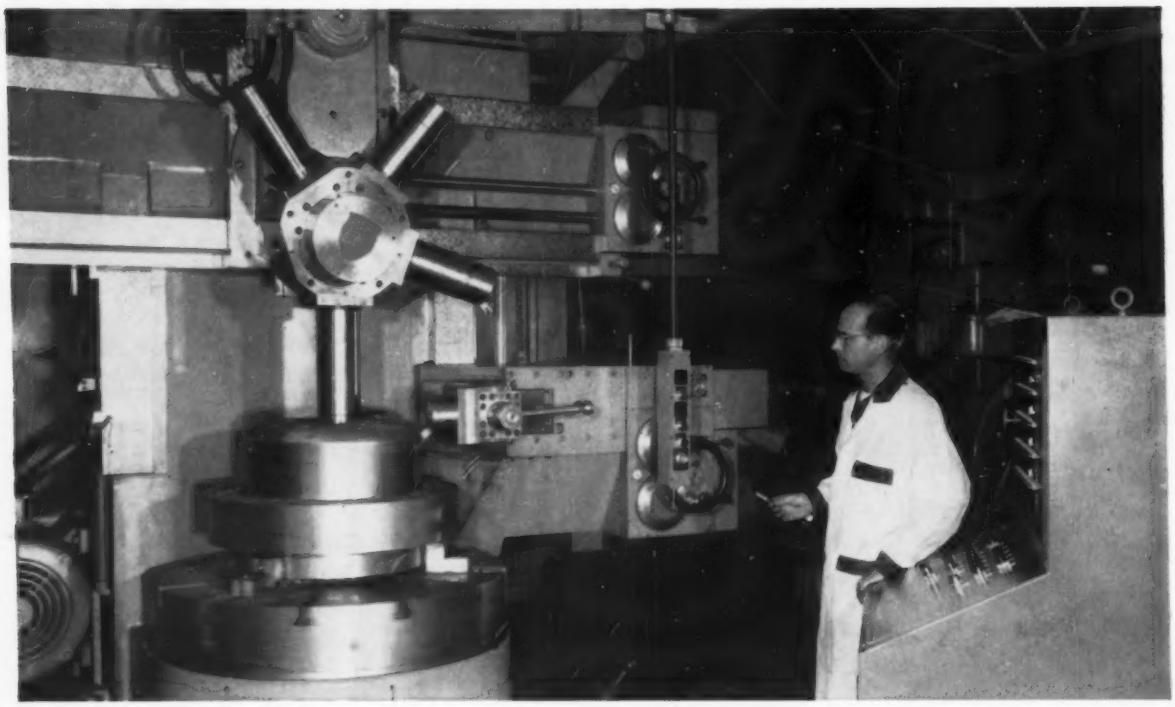

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